TEST REPORT

Product Name ： Camera Hub G5 Pro (Wi-Fi)
Model Number ： CH-C07E, CH-C07D

Prepared for	:	Lumi United Technology Co., Ltd.
Address	:	Room 801-804, Building 1, Chongwen Park, Nanshan iPark, No. 3370, Liuxian Avenue, Fuguang Community, Taoyuan Residential District, Nanshan District, Shenzhen, China
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Report Number	:	ENS2411080085W02305R
Date(s) of Tests	:	November 12, 2024 to November 20, 2024
Date of issue	:	November 23, 2024

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TEST RESULT CERTIFICATION

Applicant	:	Lumi United Technology Co., Ltd.
Address	:	Room 801-804, Building 1, Chongwen Park, Nanshan iPark, No. 3370, Liuxian Avenue, Fuguang Community, Taoyuan Residential District, Nanshan District, Shenzhen, China
Manufacturer	:	Lumi United Technology Co., Ltd.
Address	:	Room 801-804, Building 1, Chongwen Park, Nanshan iPark, No. 3370, Liuxian Avenue, Fuguang Community, Taoyuan Residential District, Nanshan District, Shenzhen, China
EUT	:	Camera Hub G5 Pro (Wi-Fi)
Model Name	:	CH-C07E, CH-C07D
Trademark	:	Aqara

Measurement Procedure Used:

APPLICABLE STANDARDS	
STANDARD	**TEST RESULT**
ETSI EN 300 328 V2.2.2: 2019	PASS
AS/NZS 4268: 2017 Amd 1:2021	PASS

The device described above is tested by EMTEK (Shenzhen) Co., Ltd. to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and EMTEK (Shenzhen) Co., Ltd. is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the ETSI EN 300 328 V2.2.2: 2019 and AS/NZS 4268: 2017 Amd 1:2021 requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of EMTEK (Shenzhen) Co., Ltd.

Date of Test :	November 12, 2024 to November 20, 2024
Prepared by :	Una Yu Una Yu/Editor
Reviewer :	Sewen Guo Sewen Guo/Supervisor
Approver & Authorized Signer :	Lisa Wang/Manager

EMTEK (SHENZHEN) CO., LTD. TESTING

1. EUT DESCRIPTION

Product:	Camera Hub G5 Pro (Wi-Fi)
Model Number:	CH-C07E, CH-C07D
Test Voltage:	AC 230V/50Hz
Modulation:	O-QPSK
Operating Frequency Range(s):	2405-2480MHz
Number of Channels:	16 Channels
Channel Separation:	5MHz
Smart system:	☒SISO
Max Transmit Power:	7.33 dBm
Antenna:	FPC Antenna
Antenna Gain:	0.32 dBi
Temperature Range:	-30~+50℃

Note: *for more details, please refer to the user's manual of the EUT.*

2.INFORMATION AS REQUIRED BY EN 300 328 V2.2.2

EN 300 328	Information Is Provided By The Manufacturer	
The type of modulation used by the equipment	☐ FHSS ☒ other forms of modulation	
In Case Of FHSS Modulation:	☐ In case of non-Adaptive Frequency Hopping equipment The number of Hopping Frequencies: ☐ In case of Adaptive Frequency Hopping Equipment The maximum number of Hopping Frequencies: The minimum number of Hopping Frequencies:	
The worst case operational mode for each of the following tests:	RF Output Power	7.33 dBm
	Power Spectral Density	5.24 dBm/MHz
	Duty Cycle, Tx-Sequence, Tx-gap.	N/A
	Dwell Time, Minimum Frequency Occupation & Hopping Sequence (only for FHSS equipment)	N/A
	Hopping Frequency Separation (only for FHSS equipment)	N/A
	Medium Utilisation.	N/A
	Adaptivity	N/A
	Receiver Blocking	PASS
	Occupied Channel Bandwidth	2.258MHz
	Transmitter Unwanted Emissions in the OOB domain.	PASS
	Transmitter Unwanted Emissions in the spurious domain	PASS
	Receiver spurious emissions	PASS
The different transmit operating modes (tick all that apply):	☒ Operating mode 1: Single Antenna Equipment ☒ Equipment with only 1 antenna ☐ Equipment with 2 diversity antennas but only 1 antenna active at any moment in time ☐ Smart Antenna Systems with 2 or more antennas, but operating in a (legacy) mode where only 1 antenna is used. (e.g. IEEE 802.11™ [i.3] legacy mode in smart antenna systems)	

	☐ Operating mode 2: Smart Antenna Systems - Multiple Antennas without beam forming ☐ Single spatial stream / Standard throughput / (e.g. IEEE 802.11™ [i.3] legacy mode) ☐ High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1 ☐ High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2 ☐ Operating mode 3: Smart Antenna Systems - Multiple Antennas with beam forming ☐ Single spatial stream / Standard throughput (e.g. IEEE 802.11™ [i.3] legacy mode) ☐ High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1 ☐ High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2
Operating Frequency Range(s) of the equipment:	Operating Frequency Range: 2405 MHz to 2480 MHz
Occupied Channel Bandwidth(s):	Occupied Channel Bandwidth: 2.258MHz
Type of Equipment (stand-alone, combined, plug-in radio device, etc.):	☒ Stand-alone ☐ Combined Equipment (Equipment where the radio part is fully integrated within another type of equipment) ☐ Plug-in radio device (Equipment intended for a variety of host systems) ☐ Other
Describe the test modes available which can facilitate testing:	Modulation Mode: O-QPSK Test Frequency: Low Frequency, Middle Frequency, High Frequency
The equipment type (e.g. Bluetooth®, IEEE 802.11™ [i.3], proprietary, etc.):	IEEE802.15.4
NOTE: N/A means not applicable.	

Revision History

Version	Report No.	Revision Date	Summary
	ENS2411080085W02305R	/	Original Report

3.SUMMARY OF TEST RESULT

Clause (EN 300 328)	Test Parameter	Verdict	Remark
4.3.2.2	RF Output Power	PASS	
4.3.2.3	Power Spectral Density	PASS	
4.3.2.4	Duty Cycle and Tx-Sequence and Tx-Gap	N/A (See Note1)	Only applicable for non-adaptive equipment Output Power >10dBm
4.3.2.5	Medium Utilisation Factor	N/A (See Note1)	Only applicable for non-adaptive equipment Output Power >10dBm
4.3.2.6	Adaptivity (adaptive equipment using modulations other than FHSS)	N/A (See Note1)	
4.3.2.7	Occupied Channel Bandwidth	PASS	
4.3.2.8	Transmitter Unwanted Emission in the Out-of Band	PASS	
4.3.2.9	Transmitter Unwanted Emissions in the Spurious Domain	PASS	
4.3.2.10	Receiver Spurious Emissions	PASS	
4.3.2.11	Receiver Blocking	PASS (See Note2)	Receiver category 2
4.3.2.12	Geo-location capability	N/A (See Note1)	Only applicable for have Geo-location function equipment

NOTE1: N/A (Not Applicable)

NOTE2: Receiver category 1(Adaptive equipment with a maximum RF output power greater than 10 dBm e.i.r.p. shall be considered as receiver category 1 equipment.)

Receiver category 2(Non-adaptive equipment with a Medium Utilization (MU) factor greater than 1 % and less than or equal to 10 % or adaptive equipment with a maximum RF output power of 10 dBm e.i.r.p. shall be considered as receiver category 2 equipment.)

Receiver category 3(Non-adaptive equipment with a maximum Medium Utilization (MU) factor of 1 % or adaptive equipment with a maximum RF output power of 0 dBm e.i.r.p. shall be considered as receiver category 3 equipment.)

4. TEST METHODOLOGY

4.1 GENERAL DESCRIPTION OF APPLIED STANDARDS

According to its specifications, the EUT must comply with the requirements of the following standards:

ETSI EN 300 328 –Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

4.2 MEASUREMENT EQUIPMENT USED

For Spurious Emissions Test

Equipment Type	Manufacturer	Model No.	Serial Number	Last Cal.
EMI Test Receiver	Rohde & Schwarz	ESU 26	100154	2024/5/10
Pre-Amplifie	Lunar EM	LNA30M3G-25	J10100000070	2024/5/10
Bilog Antenna	Schwarzbeck	VULB9163	659	2023/9/1
Horn antenna	Schwarzbeck	BBHA9120D	9120D-1177	2023/5/12
Pre-Amplifie	SKET	LNPA_0118G-45	SK2019051801	2024/5/10
Loop Antenna	Schwarzbeck	FMZB1519	1519-012	2023/5/12
Spectrum Analyzer	Rohde & Schwarz	FSV40	100967	2024/5/10
Horn antenna	Schwarzbeck	BBHA9120D	9120D-1198	2023/6/2
Bilog Antenna	Schwarzbeck	VULB9163	661	2023/6/2
Cable	H+B	NmSm-05-C15052	N/A	2024/5/10
Cable	H+B	NmSm-2-C15201	N/A	2024/5/10
Cable	H+B	NmNm-7-C15702	N/A	2024/5/10
Cable	H+B	SAC-40G-1	414	2024/5/10
Cable	H+B	SUCOFLEX104	MY14871/4	2024/5/10
Cable	H+B	BLU18A-NmSm-6500	D8501	2024/5/10
Band reject Filter(50dB)	WI/DE	WRCGV-2400(2400-2485MHz)	2	2024/5/10
Remark: *Each piece of equipment is scheduled for calibration once a year.*				

For other test items:

Equipment Type	Manufacturer	Model No.	Serial Number	Last Cal.
Vector Signal Generater	Agilent	N5182B	My53050553	2024/5/10
Analog Signal Generator	Agilent	N5171B	My53050878	2024/5/10
Signal Analyzer	Agilent	N9010A	My53470879	2024/5/10
Wideband Radio Communication Tester	R&S	CMW500	140822	2024/5/10
Temperature&Humidity test chamber	ESPEC	EL-02KA	12107166	2024/5/10
Remark: *Each piece of equipment is scheduled for calibration once a year.*				

4.3 DESCRIPTION OF TEST MODES

The EUT has been tested under its typical operating condition.
The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test of channel included the lowest and middle and highest frequency to perform the test, and then record on this report.

Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

☒Frequency and Channel list:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
11	2405	17	2435	23	2465
12	2410	18	2440	24	2470
13	2415	19	2445	25	2475
14	2420	20	2450	26	2480
15	2425	21	2455		
16	2430	22	2460		

☒Test Frequency and Channel:

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
11	2405	18	2440	26	2480

5.FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

Bldg 69, Majialong Industry Zone District, Nanshan District, Shenzhen, China
The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with preselectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

5.3 LABORATORY ACCREDITATIONS AND LISTINGS

Site Description		
Name of Firm	:	EMTEK(SHENZHEN) CO., LTD.
Site Location	:	Bldg 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China

6.TEST SYSTEM UNCERTAINTY

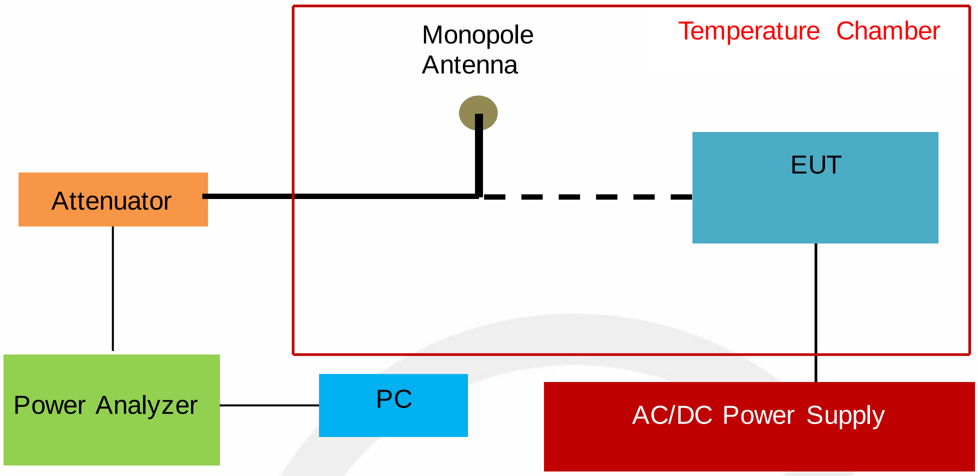
Maximum measurement uncertainty of the test system.

Test Parameter	measurement uncertainty
RF Output Power	±1.0%
Power Spectral Density	±0.9%
Duty Cycle and Tx-Sequence and Tx-Gap	±1.3%
Medium Utilisation Factor	±1.5%
Occupied Channel Bandwidth	±2.3%
Transmitter Unwanted Emission in the Out-of Band	±1.2%
Transmitter Unwanted Emissions in the Spurious Domain	±2.7%
Receiver Spurious Emissions	±2.7%
Temperature	±3.2%
Humidity	±2.5%

7.SETUP OF EQUIPMENT UNDER TEST

7.1 SETUP CONFIGURATION OF EUT

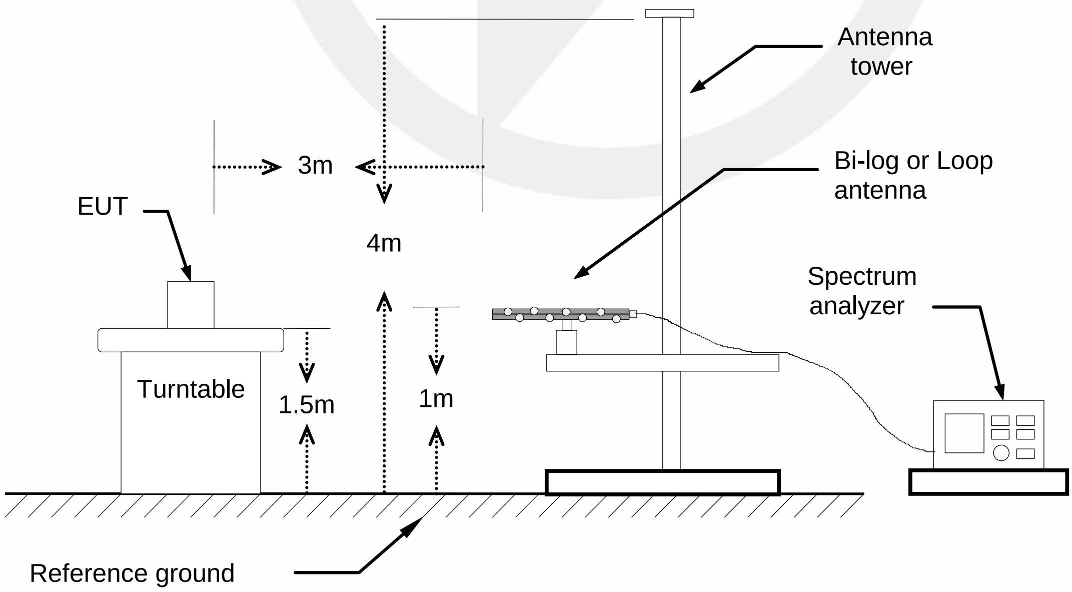
Conducted measurements configuration of EUT shall be as follows:



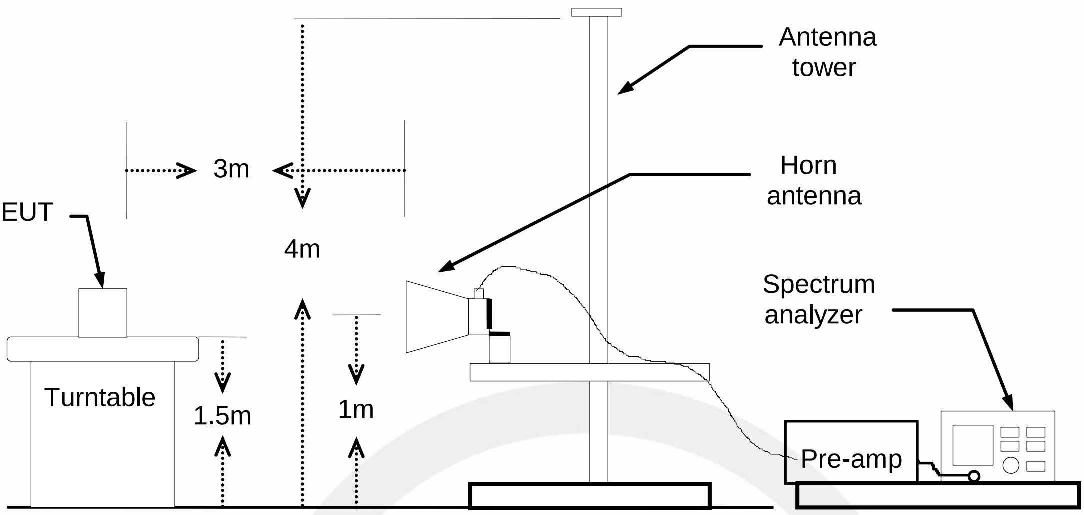
Remarks:
The Signal Analyzer could be connected to a monopole antenna or directly connected to the EUT, if the EUT has already employing an antenna connector.

Radiated measurements configuration of EUT shall be as follows:

Below 1GHz



Above 1GHz



7.2 SUPPORT EQUIPMENT

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite

Auxiliary Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number

Notes:

1. *All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*
2. *Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.*
3. *Unless otherwise denoted as EUT in 『Remark』 column , device(s) used in tested system is a support equipment*

8.ETSI EN 300 328 REQUIREMENTS

8.1 RF OUTPUT POWER

8.1.1 Applicable standard

EN 300 328 Clause 4.3.2.2

8.1.2 Conformance Limit

The Maximum RF Output Power <= 100 mW (20 dBm) (EIRP) at both Normal and Extreme conditions.

8.1.3 Test Configuration

The measurements for RF output power shall be performed at both normal environmental conditions and at the extremes of the operating temperature range.

Radiated measurements shall only be used for integral antenna equipment that does not have a temporary antenna connector(s) provided.
Conducted measurements shall be used for antenna equipment provided a temporary antenna connector(s)

8.1.4 Test Procedure

1. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.2.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.2.2 for the measurement method.

The test procedure shall be as follows:
■ Conducted measurements
Step 1:
• Use a fast power sensor with a minimum sensitivity of -40 dBm and capable of minimum 1 MS/s.
• Use the following settings:
- Sample speed 1 MS/s or faster.
- The samples shall represent the RMS power of the signal.
- Measurement duration: For non-adaptive equipment: equal to the observation period defined in clause 4.3.1.3.2 or clause 4.3.2.4.2. For adaptive equipment, the measurement duration shall be long enough to ensure a minimum number of bursts (at least 10) are captured.
For adaptive equipment, to increase the measurement accuracy, a higher number of bursts may be used.
Step 2:
• For conducted measurements on devices with one transmit chain:
- Connect the power sensor to the transmit port, sample the transmit signal and store the raw data. Use these stored samples in all following steps.
• For conducted measurements on devices with multiple transmit chains:
- Connect one power sensor to each transmit port for a synchronous measurement on all transmit ports.
- Trigger the power sensors so that they start sampling at the same time. Make sure the time difference between the samples of all sensors is less than 500 ns.
- For each individual sampling point (time domain), sum the coincident power samples of all ports and store them. Use these summed samples in all following steps.
Step 3:
• Find the start and stop times of each burst in the stored measurement samples.
The start and stop times are defined as the points where the power is at least 30 dB below the highest value of the stored samples in step 2.
In case of insufficient dynamic range, the value of 30 dB may need to be reduced appropriately.
Step 4:
• Between the start and stop times of each individual burst calculate the RMS power over the burst using the formula below. Save these Pburst values, as well as the start and stop times for each burst.

$$P_{burst} = \frac{1}{k}\sum_{n=1}^{k} P_{sample}(n)$$

with k being the total number of samples and n the actual sample number.

Step 5:
• The highest of all Pburst values (value "A" in dBm) will be used for maximum e.i.r.p. calculations.

Step 6:
• Add the (stated) antenna assembly gain "G" in dBi of the individual antenna.
• If applicable, add the additional beamforming gain "Y" in dB.
• If more than one antenna assembly is intended for this power setting, the maximum overall antenna gain (G or G + Y) shall be used.
• The RF Output Power (P) shall be calculated using the formula below: P = A + G + Y
• This value, which shall comply with the limit given in clause 4.3.1.2.3 or clause 4.3.2.2.3, shall be recorded in the test report.

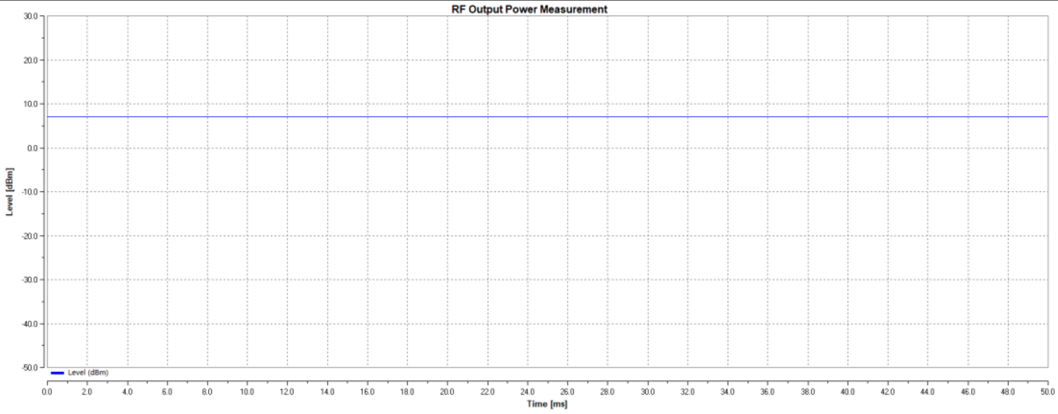
■ Radiated measurements

This method shall only be used for integral antenna equipment that does not have a temporary antenna connector(s) provided.
When performing radiated measurements, the UUT shall be configured and antenna(s) positioned (including smart antenna systems and equipment capable of beamforming) for maximum e.i.r.p. towards the measuring antenna. This position shall be recorded.
A test site as described in annex B and applicable measurement procedures as described in annex C shall be used.
Taking into account the calibration factor from the measurement site, the test procedure for RF Output Power is further as described under clause 5.4.2.2.1.2, step 1 to step 5. The RF Output Power P is equal to the value A obtained in step 5. The test procedure for Duty Cycle, Tx-sequence, Tx-gap is further as described in clause 5.4.2.2.1.3 and the test procedure for Medium Utilization is further as described in clause 5.4.2.2.1.4.

8.1.5 Test Results

Temperature: Refer to the following table **Humidity:** 55 % RH

Test Conditions			Transmitter Power (dBm)		
			Temp (25)°C	Temp (-30)°C	Temp (50)°C
MODES	CHANNEL	(VOLT) POWER	DC 5V	DC 5V	DC 5V
☒ 802.15.4	2405MHz	RMS	7.33	7.03	7.22
	2440 MHz	RMS	7.29	7.00	7.16
	2480 MHz	RMS	6.93	6.88	6.77
Limit			<= 20dBm		
Verdict			PASS	PASS	PASS



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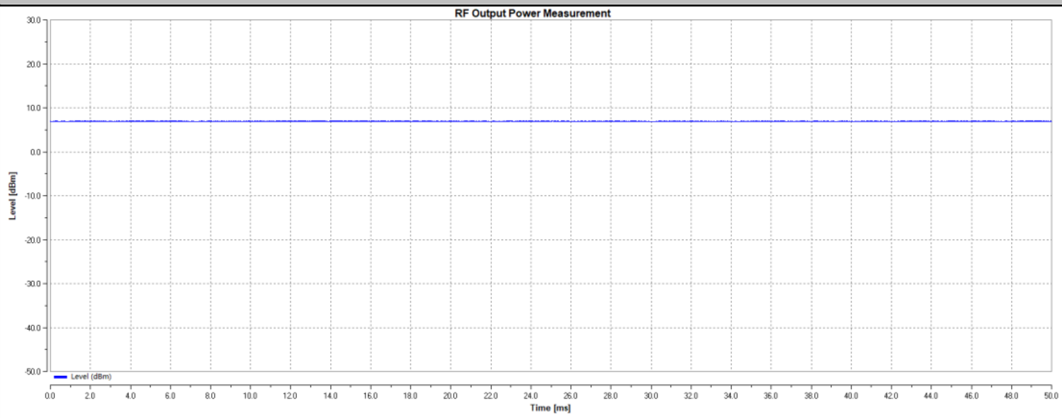

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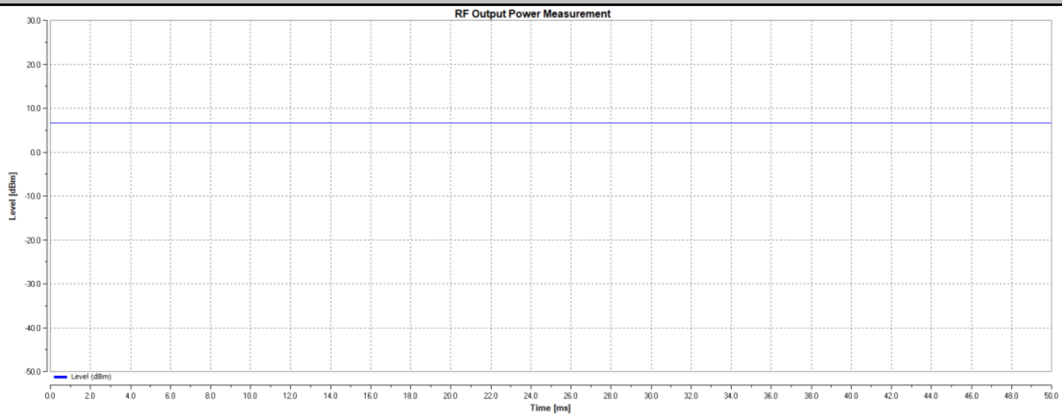

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8.2 POWER SPECTRAL DENSITY

8.2.1 Applicable standard

According to ETSI EN 300 328 clause 4.3.2.3

8.2.2 Conformance Limit

The Maximum Power Spectrum Density <=10 dBm/MHz

8.2.3 Test Configuration

The measurements for power spectral density shall only be performed at normal test conditions.

Radiated measurements shall only be used for integral antenna equipment that does not have a temporary antenna connector(s) provided.
Conducted measurements shall be used for antenna equipment provided a temporary antenna connector(s) provided.

8.2.4 Test Procedure

1. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.3.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.3.2 for the measurement method.

The test procedure shall be as follows:
■Conducted measurement
●Option 1: For equipment with continuous and non-continuous transmissions
The transmitter shall be connected to a spectrum analyser and the Power Spectral Density (PSD) as defined in clause 4.3.2.3 shall be measured and recorded.
Step 1:
Connect the UUT to the spectrum analyser and use the following settings:
• Start Frequency: 2 400 MHz
• Stop Frequency: 2 483,5 MHz
• Resolution BW: 10 kHz
• Video BW: 30 kHz
• Sweep Points: > 8 350; for spectrum analysers not supporting this number of sweep points, the frequency band may be segmented
• Detector: RMS
• Trace Mode: Max Hold
• Sweep time: For non-continuous transmissions: 2 × Channel Occupancy Time × number of sweep points
For continuous transmissions: 10 s; the sweep time may be increased further until a value where the sweep time has no further impact anymore on the RMS value of the signal.
For non-continuous signals, wait for the trace to stabilize.
Save the data (trace data) set to a file.
Step 2:
For conducted measurements on smart antenna systems using either operating mode 2 or operating mode 3 (see clause 5.3.2.2), repeat the measurement for each of the transmit ports. For each sampling point (frequency domain), add up the coincident power values (in mW) for the different transmit chains and use this as the new data set.
Step 3:
Add up the values for power for all the samples in the file using the formula below.

$$P_{Sum} = \sum_{n=1}^{k} P_{sample}(n)$$

With k being the total number of samples and n the actual sample number.

Step 4:
Normalize the individual values for power (in dBm) so that the sum is equal to the RF Output Power (e.i.r.p.) measured in clause 5.4.2 and save the corrected data. The following formulas can be used:

$$C_{Corr} = P_{Sum} - P_{e.i.r.p.}$$
$$P_{Samplecorr}(n) = P_{Sample}(n) - C_{Corr}$$

With n being the actual sample number

Step 5:
Starting from the first sample $P_{Samplecorr}(n)$ (lowest frequency), add up the power (in mW) of the following samples representing a 1 MHz segment and record the results for power and position (i.e. sample #1 to sample #100). This is the Power Spectral Density (e.i.r.p.) for the first 1 MHz segment which shall be recorded.
Step 6:
Shift the start point of the samples added up in step 5 by one sample and repeat the procedure in step 5 (i.e. sample #2 to sample #101).
Step 7:
Repeat step 6 until the end of the data set and record the Power Spectral Density values for each of the 1 MHz segments.
From all the recorded results, the highest value is the maximum Power Spectral Density (PSD) for the UUT. This value, which shall comply with the limit given in clause 4.3.2.3.3, shall be recorded in the test report.

●Option 2: For equipment with continuous transmission capability

This option is for equipment that can be configured to operate in a continuous transmit mode (100 % DC).
Step 1:
• Connect the UUT to the spectrum analyser and use the following settings:
- Centre Frequency: The centre frequency of the channel under test
- RBW: 1 MHz
- VBW: 3 MHz
- Frequency Span: At least 2 × Occupied Channel Bandwidth
- Detector Mode: Peak
- Trace Mode: Max Hold
Step 2:
• When the trace is complete, find the peak value of the power envelope and record the frequency.
Step 3:
• Make the following changes to the settings of the spectrum analyser:
- Centre Frequency: Equal to the frequency recorded in step 2
- Frequency Span: 3 MHz
- RBW: 1 MHz
- VBW: 3 MHz
- Sweep Time: 1 minute
- Detector Mode: RMS
- Trace Mode: Max Hold
Step 4:
• When the trace is complete, the trace shall be captured using the "Hold" or "View" option on the spectrum analyser.
• Find the peak value of the trace and place the analyser marker on this peak. This level is recorded as the highest mean power (power spectral density) D in a 1 MHz band.
• Alternatively, where a spectrum analyser is equipped with a function to measure power spectral density, this function may be used to display the power spectral density D in dBm / MHz.
• In case of conducted measurements on smart antenna systems operating in a mode with multiple transmit chains active simultaneously, the power spectral density of each transmit chain shall be measured separately to calculate the total power spectral density (value D in dBm / MHz) for the UUT.
Step 5:
• The maximum Power Spectral Density (PSD) e.i.r.p. is calculated from the above measured power spectral density D, the applicable antenna assembly gain G in dBi and if applicable the beamforming gain Y in dB, according to the formula below. This value shall be recorded in the test report. If more than one antenna assembly is intended for this power setting, the gain of the antenna assembly with the highest gain shall be used.

PSD = D + G + Y (dBm / MHz)

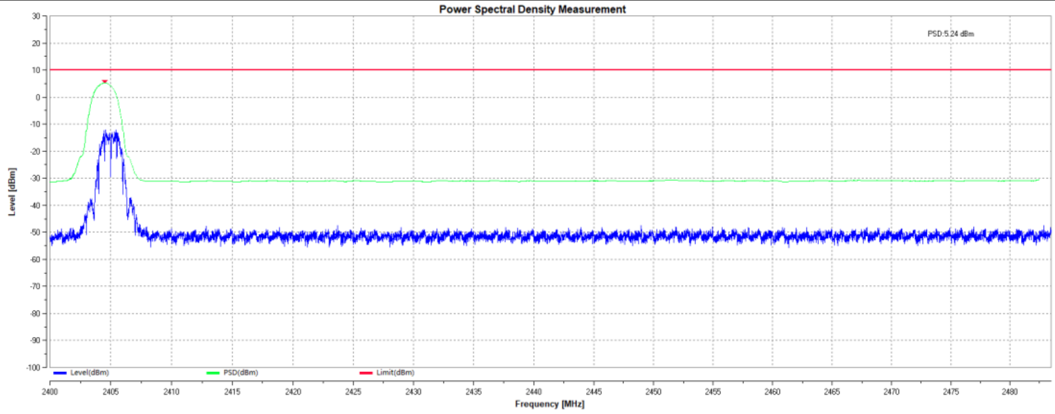
■Radiated measurement

When performing radiated measurements, the UUT shall be configured and antenna(s) positioned (including smart antenna systems and equipment capable of beamforming) for maximum e.i.r.p. towards the measuring antenna. This configuration/position shall be recorded for future use (see clause C.5.3.4 and clause C.5.4.4).
A test site as described in annex B and applicable measurement procedures as described in annex C shall be used.
Taking into account the calibration factor from the measurement site, the test procedure is further as described under clause 5.4.3.2.1.

8.2.5 Test Results

Temperature: 25ºC **Humidity:** 55 % RH

Test Condition		Measured Data (dBm/MHz)	Limit (dBm/MHz)	Verdict
☒ 802.15.4	2405MHz	5.24	<=10	PASS
	2440 MHz	5.17	<=10	PASS
	2480 MHz	4.84	<=10	PASS



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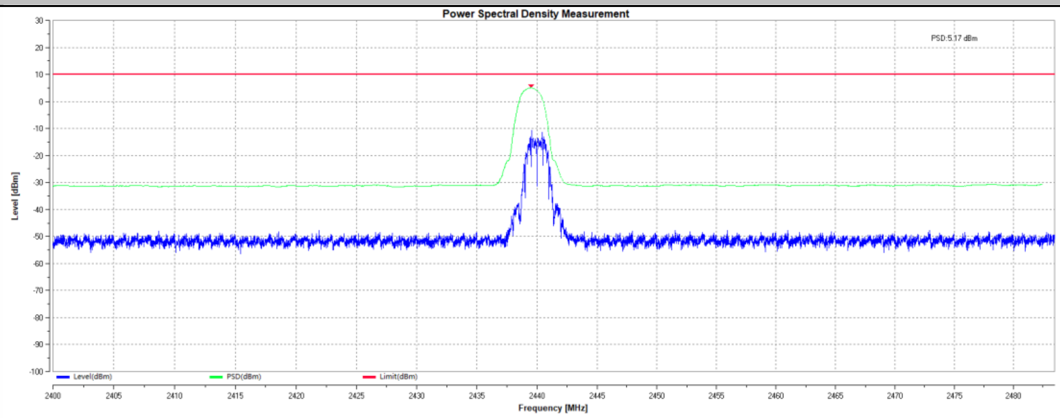
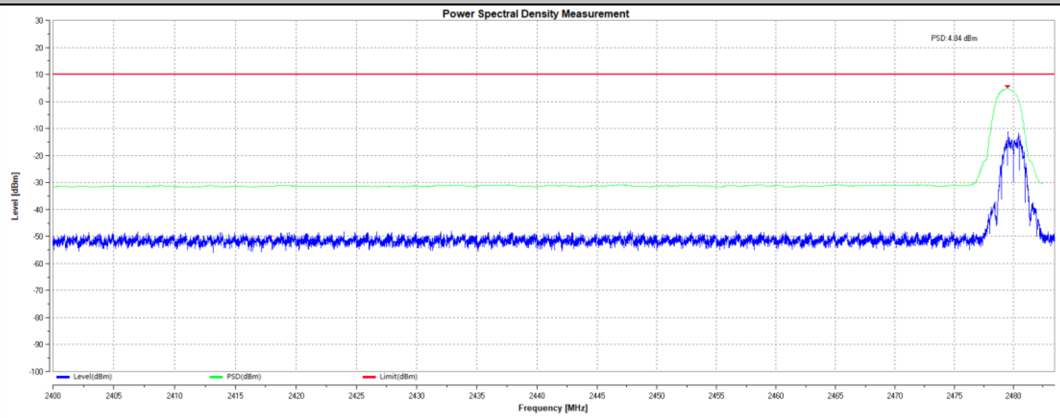


ZIGB-Ant1-2440-PASS



ZIGB-Ant1-2480-PASS

8.3 OCCUPIED CHANNEL BANDWIDTH

8.3.1 Applicable standard

ETSI EN 300 328 clause 4.3.2.7

8.3.2 Conformance Limit

The requirement applies to all types of equipment using wide band modulation other than FHSS
The occupied channel bandwidth is the bandwidth that contains 99% of the power of the signal
The Occupied Channel Bandwidth shall fall completely within the band 2400-2483.5MHz
In addition, for non-adaptive equipment using wide band modulations other than FHSS and with e.i.r.p. greater than 10 dBm, the occupied channel bandwidth shall be less than 20 MHz.

8.3.3 Test Configuration

The measurements for Occupied Channel Bandwidth shall only be performed at normal test conditions.

Radiated measurements shall only be used for integral antenna equipment that does not have a temporary antenna connector(s) provided.

Conducted measurements shall be used for antenna equipment provided a temporary antenna connector(s).

8.3.4 Test Procedure

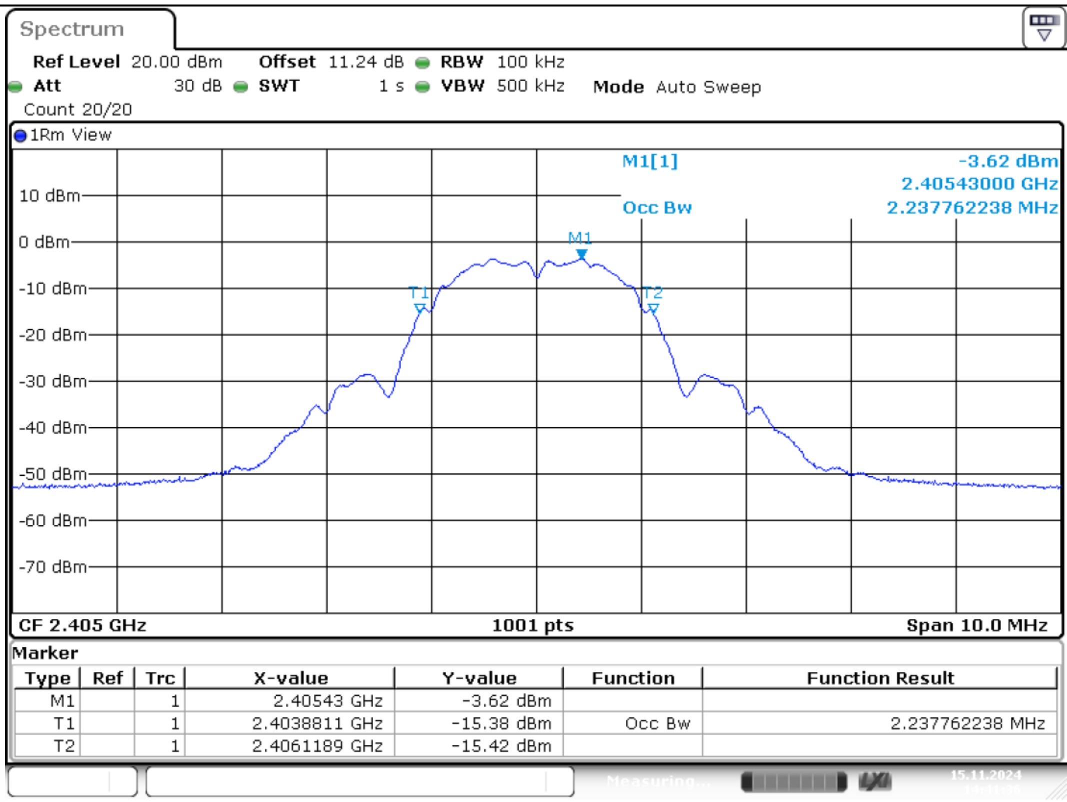
1. Please refer to ETSI EN 300 328(V2.2.2) clause 5.4.7.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.7.2 for the measurement method.

■Conducted measurement
The measurement procedure shall be as follows:
Step 1:
Connect the UUT to the spectrum analyser and use the following settings:
• Centre Frequency: The centre frequency of the channel under test
• Resolution BW: ~ 1 % of the span without going below 1 %
• Video BW: 3 × RBW
• Frequency Span: 2 × Nominal Channel Bandwidth
• Detector Mode: RMS
• Trace Mode: Max Hold
• Sweep time: 1 s
Step 2:
Wait for the trace to stabilize.
Find the peak value of the trace and place the analyser marker on this peak.
Step 3:
Use the 99 % bandwidth function of the spectrum analyser to measure the Occupied Channel Bandwidth of the UUT.
This value shall be recorded.
Make sure that the power envelope is sufficiently above the noise floor of the analyser to avoid the noise signals left and right from the power envelope being taken into account by this measurement.
■Radiated measurement
The test set up as described in annex B and the applicable measurement procedures described in annex C shall be used.
Alternatively, a test fixture may be used.
The test procedure is as described under clause 5.4.7.2.1.

8.3.5 Test Results

Temperature: 25ºC **Humidity:** 55 % RH

TestMode	Antenna	Frequency[MHz]	OCB[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
ZIGB	Ant1	2405	2.238	2403.8811	2406.1189	2400 to 2483.5	PASS
ZIGB	Ant1	2440	2.248	2438.8811	2441.1289	2400 to 2483.5	PASS
ZIGB	Ant1	2480	2.258	2478.8711	2481.1289	2400 to 2483.5	PASS



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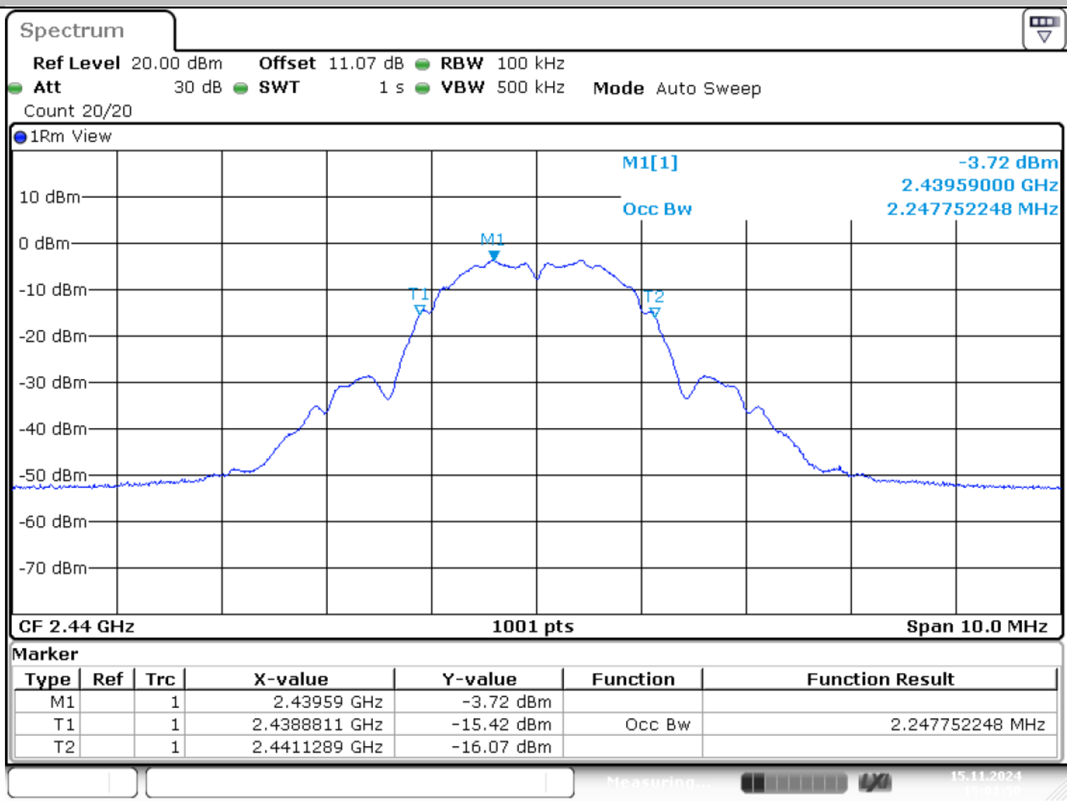
ZIGB-Ant1-2405-PASS



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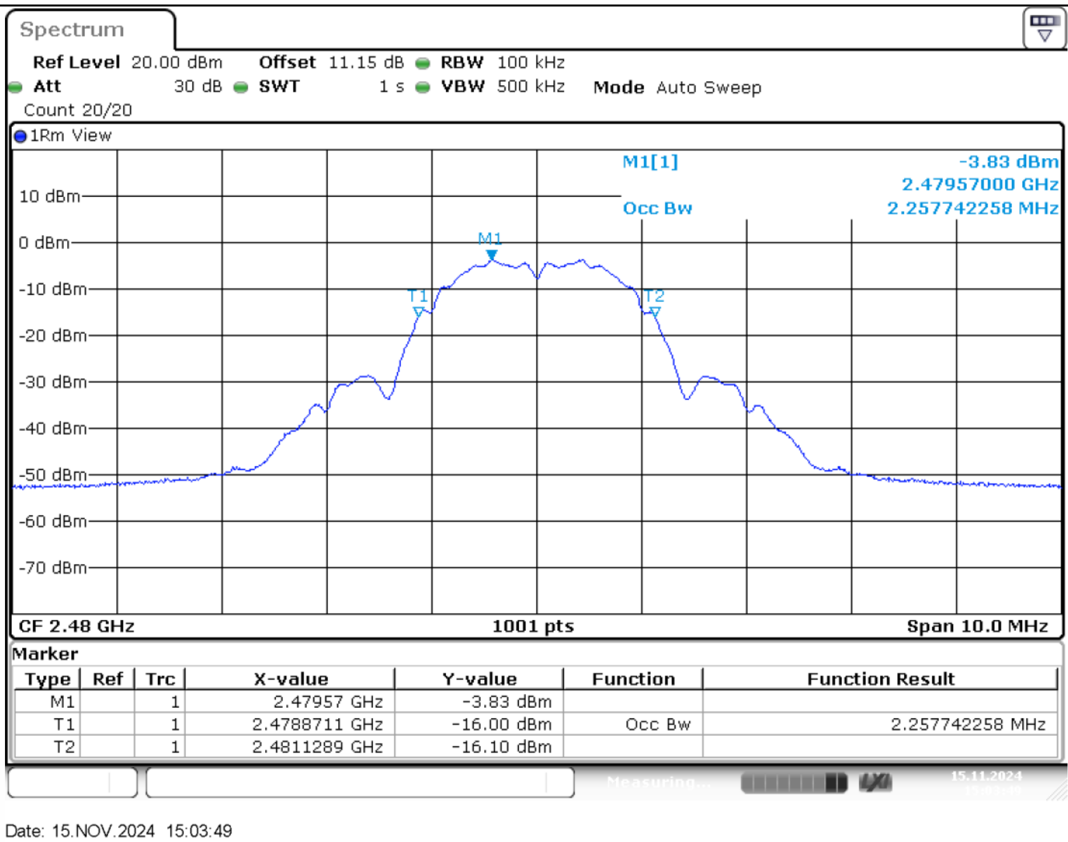
ZIGB-Ant1-2440-PASS



ZIGB-Ant1-2480-PASS

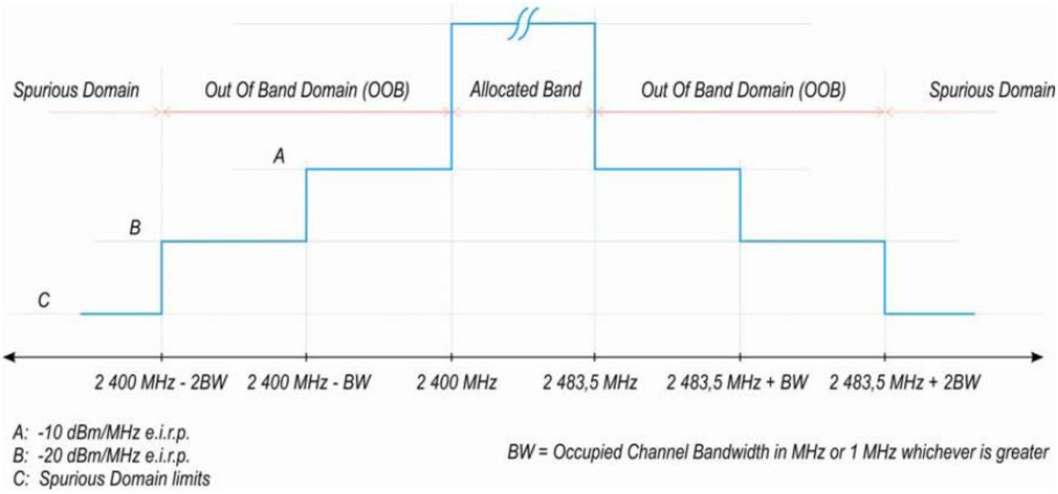
8.4 TRANSMITTER UNWANTED EMISSION IN THE OUT-OF BAND

8.4.1 Applicable standard

ETSI EN 300 328 clause 4.3.2.8

8.4.2 Conformance Limit

The transmitter unwanted emissions in the out-of-band domain but outside the allocated band, shall not exceed the limits of the mask given in below figure.



8.4.3 Test Configuration

The measurements for emission in the out-of band shall only be performed at normal test conditions.

Radiated measurements shall only be used for integral antenna equipment that does not have a temporary antenna connector(s) provided.

Conducted measurements shall be used for antenna equipment provided a temporary antenna connector(s).

8.4.4 Test Procedure

1. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.8.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.8.2 for the measurement method.

■ Conducted measurement

The applicable mask is defined by the measurement results from the tests performed under clause 5.4.7 (Occupied Channel Bandwidth).

The Out-of-band emissions within the different horizontal segments of the mask provided in figure 1 and figure 3 shall be measured using the procedure in step 1 to step 6 below. This method assumes the spectrum analyser is equipped with the Time Domain Power option.

Step 1:

• Connect the UUT to the spectrum analyser and use the following settings:

- Measurement Mode: Time Domain Power
- Centre Frequency: 2 484 MHz
- Span: 0 Hz
- Resolution BW: 1 MHz
- Filter mode: Channel filter
- Video BW: 3 MHz
- Detector Mode: RMS
- Trace Mode: Max Hold
- Sweep Mode: Single Sweep
- Sweep Points: Sweep time [μs] / (1 μs) with a maximum of 30 000

- Trigger Mode: Video
- Sweep Time: > 120 % of the duration of the longest burst detected during the measurement of the RF Output Power

Step 2 (segment 2 483,5 MHz to 2 483,5 MHz + BW):
• Adjust the trigger level to select the transmissions with the highest power level.
• For frequency hopping equipment operating in a normal hopping mode, the different hops will result in signal bursts with different power levels. In this case the burst with the highest power level shall be selected.
• Set a window (start and stop lines) to match with the start and end of the burst and in which the RMS power shall be measured using the Time Domain Power function.
• Select RMS power to be measured within the selected window and note the result which is the RMS power within this 1 MHz segment (2 483,5 MHz to 2 484,5 MHz). Compare this value with the applicable limit provided by the mask.
• Increase the centre frequency in steps of 1 MHz and repeat this measurement for every 1 MHz segment within the range 2 483,5 MHz to 2 483,5 MHz + BW. The centre frequency of the last 1 MHz segment shall be set to 2 483,5 MHz + BW - 0,5 MHz (which means this may partly overlap with the previous 1 MHz segment).
Step 3 (segment 2 483,5 MHz + BW to 2 483,5 MHz + 2BW):
• Change the centre frequency of the analyser to 2 484 MHz + BW and perform the measurement for the first 1 MHz segment within range 2 483,5 MHz + BW to 2 483,5 MHz + 2BW. Increase the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 483,5 MHz + 2 BW - 0,5 MHz (which means this may partly overlap with the previous 1 MHz segment).
Step 4 (segment 2 400 MHz - BW to 2 400 MHz):
• Change the centre frequency of the analyser to 2 399,5 MHz and perform the measurement for the first 1 MHz segment within range 2 400 MHz - BW to 2 400 MHz Reduce the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 400 MHz - BW + 0,5 MHz (which means this may partly overlap with the previous 1 MHz segment).
Step 5 (segment 2 400 MHz - 2BW to 2 400 MHz - BW):
• Change the centre frequency of the analyser to 2 399,5 MHz - BW and perform the measurement for the first 1 MHz segment within range 2 400 MHz - 2BW to 2 400 MHz - BW. Reduce the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 400 MHz - 2BW + 0,5 MHz (which means this may partly overlap with the previous 1 MHz segment).
Step 6:
• In case of conducted measurements on equipment with a single transmit chain, the declared antenna assembly gain "G" in dBi shall be added to the results for each of the 1 MHz segments and compared with the limits provided by the mask given in figure 1 or figure 3. If more than one antenna assembly is intended for this power setting, the antenna with the highest gain shall be considered.
• In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains), the measurements need to be repeated for each of the active transmit chains. The declared antenna assembly gain "G" in dBi for a single antenna shall be added to these results. If more than one antenna assembly is intended for this power setting, the antenna with the highest gain shall be considered. Comparison with the applicable limits shall be done using any of the options given below:
- Option 1: the results for each of the transmit chains for the corresponding 1 MHz segments shall be added. The additional beamforming gain "Y" in dB shall be added as well and the resulting values compared with the limits provided by the mask given in figure 1 or figure 3.
- Option 2: the limits provided by the mask given in figure 1 or figure 3 shall be reduced by $10 \times \log10(Ach)$ and the additional beamforming gain "Y" in dB. The results for each of the transmit chains shall be individually compared with these reduced limits.

NOTE: Ach refers to the number of active transmit chains.
It shall be recorded whether the equipment complies with the mask provided in figure 1 or figure 3.

■ Radiated measurement
The test set up as described in annex B and the applicable measurement procedures described in annex C shall be used. Alternatively a test fixture may be used.
The test procedure is as described under clause 5.4.8.2.1.

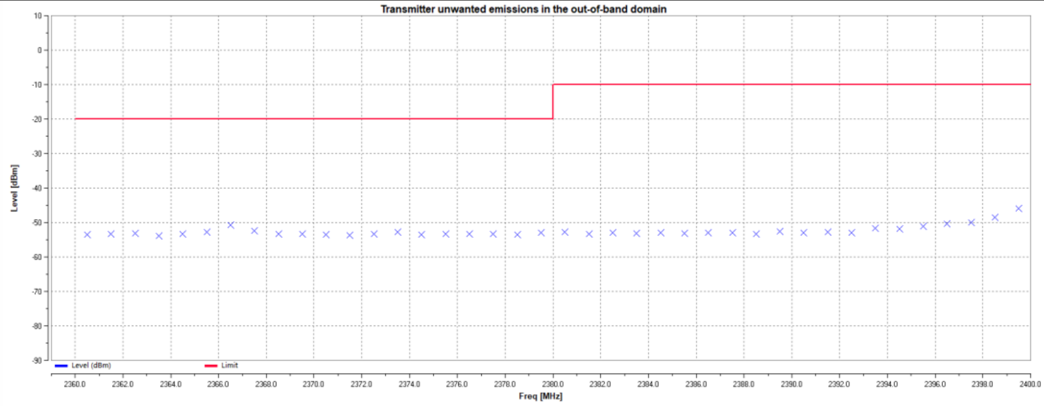
8.4.5 Test Results

All the modulation modes were tested; the data of the worst mode are described in the following table.

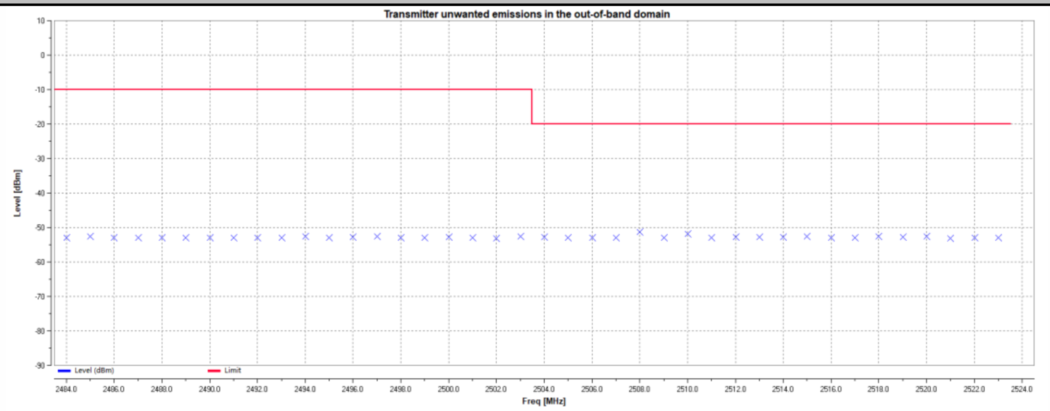
TestMode	Antenna	Frequency[MHz]	Freq. [MHz]	Level[dBm]	Limit[dBm]	Verdict
ZIGB	Ant1	2405	2360.5	-53.47	-20.00	PASS
ZIGB	Ant1	2405	2361.5	-53.37	-20.00	PASS
ZIGB	Ant1	2405	2362.5	-53.23	-20.00	PASS
ZIGB	Ant1	2405	2363.5	-53.82	-20.00	PASS
ZIGB	Ant1	2405	2364.5	-53.33	-20.00	PASS
ZIGB	Ant1	2405	2365.5	-52.71	-20.00	PASS
ZIGB	Ant1	2405	2366.5	-50.81	-20.00	PASS
ZIGB	Ant1	2405	2367.5	-52.45	-20.00	PASS
ZIGB	Ant1	2405	2368.5	-53.29	-20.00	PASS
ZIGB	Ant1	2405	2369.5	-53.33	-20.00	PASS
ZIGB	Ant1	2405	2370.5	-53.54	-20.00	PASS
ZIGB	Ant1	2405	2371.5	-53.66	-20.00	PASS
ZIGB	Ant1	2405	2372.5	-53.38	-20.00	PASS
ZIGB	Ant1	2405	2373.5	-52.74	-20.00	PASS
ZIGB	Ant1	2405	2374.5	-53.44	-20.00	PASS
ZIGB	Ant1	2405	2375.5	-53.30	-20.00	PASS
ZIGB	Ant1	2405	2376.5	-53.27	-20.00	PASS
ZIGB	Ant1	2405	2377.5	-53.33	-20.00	PASS
ZIGB	Ant1	2405	2378.5	-53.49	-20.00	PASS
ZIGB	Ant1	2405	2379.5	-52.91	-20.00	PASS
ZIGB	Ant1	2405	2380.5	-52.71	-10.00	PASS
ZIGB	Ant1	2405	2381.5	-53.26	-10.00	PASS
ZIGB	Ant1	2405	2382.5	-53.02	-10.00	PASS
ZIGB	Ant1	2405	2383.5	-53.24	-10.00	PASS
ZIGB	Ant1	2405	2384.5	-52.99	-10.00	PASS
ZIGB	Ant1	2405	2385.5	-53.21	-10.00	PASS
ZIGB	Ant1	2405	2386.5	-52.89	-10.00	PASS
ZIGB	Ant1	2405	2387.5	-52.88	-10.00	PASS
ZIGB	Ant1	2405	2388.5	-53.26	-10.00	PASS
ZIGB	Ant1	2405	2389.5	-52.56	-10.00	PASS
ZIGB	Ant1	2405	2390.5	-52.94	-10.00	PASS
ZIGB	Ant1	2405	2391.5	-52.72	-10.00	PASS
ZIGB	Ant1	2405	2392.5	-52.96	-10.00	PASS
ZIGB	Ant1	2405	2393.5	-51.66	-10.00	PASS
ZIGB	Ant1	2405	2394.5	-51.79	-10.00	PASS
ZIGB	Ant1	2405	2395.5	-51.17	-10.00	PASS
ZIGB	Ant1	2405	2396.5	-50.33	-10.00	PASS
ZIGB	Ant1	2405	2397.5	-49.95	-10.00	PASS
ZIGB	Ant1	2405	2398.5	-48.55	-10.00	PASS
ZIGB	Ant1	2405	2399.5	-45.87	-10.00	PASS
ZIGB	Ant1	2405	2484	-52.93	-10.00	PASS
ZIGB	Ant1	2405	2485	-52.68	-10.00	PASS
ZIGB	Ant1	2405	2486	-52.97	-10.00	PASS
ZIGB	Ant1	2405	2487	-52.89	-10.00	PASS
ZIGB	Ant1	2405	2488	-53.01	-10.00	PASS
ZIGB	Ant1	2405	2489	-52.92	-10.00	PASS
ZIGB	Ant1	2405	2490	-52.92	-10.00	PASS
ZIGB	Ant1	2405	2491	-53.04	-10.00	PASS
ZIGB	Ant1	2405	2492	-53.03	-10.00	PASS
ZIGB	Ant1	2405	2493	-52.97	-10.00	PASS
ZIGB	Ant1	2405	2494	-52.66	-10.00	PASS
ZIGB	Ant1	2405	2495	-52.91	-10.00	PASS
ZIGB	Ant1	2405	2496	-52.70	-10.00	PASS
ZIGB	Ant1	2405	2497	-52.54	-10.00	PASS
ZIGB	Ant1	2405	2498	-52.92	-10.00	PASS
ZIGB	Ant1	2405	2499	-52.91	-10.00	PASS
ZIGB	Ant1	2405	2500	-52.84	-10.00	PASS

ZIGB	Ant1	2405	2501	-52.94	-10.00	PASS
ZIGB	Ant1	2405	2502	-53.11	-10.00	PASS
ZIGB	Ant1	2405	2503	-52.61	-10.00	PASS
ZIGB	Ant1	2405	2504	-52.71	-20.00	PASS
ZIGB	Ant1	2405	2505	-52.91	-20.00	PASS
ZIGB	Ant1	2405	2506	-53.02	-20.00	PASS
ZIGB	Ant1	2405	2507	-52.94	-20.00	PASS
ZIGB	Ant1	2405	2508	-51.21	-20.00	PASS
ZIGB	Ant1	2405	2509	-53.03	-20.00	PASS
ZIGB	Ant1	2405	2510	-51.85	-20.00	PASS
ZIGB	Ant1	2405	2511	-52.91	-20.00	PASS
ZIGB	Ant1	2405	2512	-52.79	-20.00	PASS
ZIGB	Ant1	2405	2513	-52.74	-20.00	PASS
ZIGB	Ant1	2405	2514	-52.70	-20.00	PASS
ZIGB	Ant1	2405	2515	-52.63	-20.00	PASS
ZIGB	Ant1	2405	2516	-52.97	-20.00	PASS
ZIGB	Ant1	2405	2517	-52.94	-20.00	PASS
ZIGB	Ant1	2405	2518	-52.58	-20.00	PASS
ZIGB	Ant1	2405	2519	-52.82	-20.00	PASS
ZIGB	Ant1	2405	2520	-52.64	-20.00	PASS
ZIGB	Ant1	2405	2521	-53.15	-20.00	PASS
ZIGB	Ant1	2405	2522	-52.93	-20.00	PASS
ZIGB	Ant1	2405	2523	-53.02	-20.00	PASS
ZIGB	Ant1	2480	2360.5	-53.30	-20.00	PASS
ZIGB	Ant1	2480	2361.5	-52.85	-20.00	PASS
ZIGB	Ant1	2480	2362.5	-53.19	-20.00	PASS
ZIGB	Ant1	2480	2363.5	-53.26	-20.00	PASS
ZIGB	Ant1	2480	2364.5	-53.53	-20.00	PASS
ZIGB	Ant1	2480	2365.5	-53.19	-20.00	PASS
ZIGB	Ant1	2480	2366.5	-53.06	-20.00	PASS
ZIGB	Ant1	2480	2367.5	-53.61	-20.00	PASS
ZIGB	Ant1	2480	2368.5	-53.20	-20.00	PASS
ZIGB	Ant1	2480	2369.5	-53.22	-20.00	PASS
ZIGB	Ant1	2480	2370.5	-53.71	-20.00	PASS
ZIGB	Ant1	2480	2371.5	-53.41	-20.00	PASS
ZIGB	Ant1	2480	2372.5	-53.41	-20.00	PASS
ZIGB	Ant1	2480	2373.5	-53.46	-20.00	PASS
ZIGB	Ant1	2480	2374.5	-53.02	-20.00	PASS
ZIGB	Ant1	2480	2375.5	-53.19	-20.00	PASS
ZIGB	Ant1	2480	2376.5	-52.98	-20.00	PASS
ZIGB	Ant1	2480	2377.5	-53.49	-20.00	PASS
ZIGB	Ant1	2480	2378.5	-53.15	-20.00	PASS
ZIGB	Ant1	2480	2379.5	-53.59	-20.00	PASS
ZIGB	Ant1	2480	2380.5	-53.36	-10.00	PASS
ZIGB	Ant1	2480	2381.5	-53.35	-10.00	PASS
ZIGB	Ant1	2480	2382.5	-53.39	-10.00	PASS
ZIGB	Ant1	2480	2383.5	-53.07	-10.00	PASS
ZIGB	Ant1	2480	2384.5	-53.18	-10.00	PASS
ZIGB	Ant1	2480	2385.5	-53.31	-10.00	PASS
ZIGB	Ant1	2480	2386.5	-53.42	-10.00	PASS
ZIGB	Ant1	2480	2387.5	-53.65	-10.00	PASS
ZIGB	Ant1	2480	2388.5	-53.70	-10.00	PASS
ZIGB	Ant1	2480	2389.5	-53.23	-10.00	PASS
ZIGB	Ant1	2480	2390.5	-53.13	-10.00	PASS
ZIGB	Ant1	2480	2391.5	-53.32	-10.00	PASS
ZIGB	Ant1	2480	2392.5	-53.28	-10.00	PASS
ZIGB	Ant1	2480	2393.5	-53.19	-10.00	PASS
ZIGB	Ant1	2480	2394.5	-53.67	-10.00	PASS
ZIGB	Ant1	2480	2395.5	-53.15	-10.00	PASS
ZIGB	Ant1	2480	2396.5	-53.36	-10.00	PASS
ZIGB	Ant1	2480	2397.5	-53.38	-10.00	PASS
ZIGB	Ant1	2480	2398.5	-53.16	-10.00	PASS

ZIGB	Ant1	2480	2399.5	-53.07	-10.00	PASS
ZIGB	Ant1	2480	2484	-42.60	-10.00	PASS
ZIGB	Ant1	2480	2485	-44.98	-10.00	PASS
ZIGB	Ant1	2480	2486	-47.36	-10.00	PASS
ZIGB	Ant1	2480	2487	-48.66	-10.00	PASS
ZIGB	Ant1	2480	2488	-49.88	-10.00	PASS
ZIGB	Ant1	2480	2489	-50.72	-10.00	PASS
ZIGB	Ant1	2480	2490	-50.95	-10.00	PASS
ZIGB	Ant1	2480	2491	-51.66	-10.00	PASS
ZIGB	Ant1	2480	2492	-52.32	-10.00	PASS
ZIGB	Ant1	2480	2493	-52.04	-10.00	PASS
ZIGB	Ant1	2480	2494	-52.34	-10.00	PASS
ZIGB	Ant1	2480	2495	-52.72	-10.00	PASS
ZIGB	Ant1	2480	2496	-52.86	-10.00	PASS
ZIGB	Ant1	2480	2497	-52.46	-10.00	PASS
ZIGB	Ant1	2480	2498	-52.82	-10.00	PASS
ZIGB	Ant1	2480	2499	-52.34	-10.00	PASS
ZIGB	Ant1	2480	2500	-52.64	-10.00	PASS
ZIGB	Ant1	2480	2501	-52.76	-10.00	PASS
ZIGB	Ant1	2480	2502	-52.90	-10.00	PASS
ZIGB	Ant1	2480	2503	-52.81	-10.00	PASS
ZIGB	Ant1	2480	2504	-52.80	-20.00	PASS
ZIGB	Ant1	2480	2505	-52.50	-20.00	PASS
ZIGB	Ant1	2480	2506	-52.66	-20.00	PASS
ZIGB	Ant1	2480	2507	-52.60	-20.00	PASS
ZIGB	Ant1	2480	2508	-51.59	-20.00	PASS
ZIGB	Ant1	2480	2509	-52.69	-20.00	PASS
ZIGB	Ant1	2480	2510	-51.30	-20.00	PASS
ZIGB	Ant1	2480	2511	-52.71	-20.00	PASS
ZIGB	Ant1	2480	2512	-52.39	-20.00	PASS
ZIGB	Ant1	2480	2513	-52.93	-20.00	PASS
ZIGB	Ant1	2480	2514	-52.69	-20.00	PASS
ZIGB	Ant1	2480	2515	-53.00	-20.00	PASS
ZIGB	Ant1	2480	2516	-52.84	-20.00	PASS
ZIGB	Ant1	2480	2517	-52.56	-20.00	PASS
ZIGB	Ant1	2480	2518	-50.28	-20.00	PASS
ZIGB	Ant1	2480	2519	-51.54	-20.00	PASS
ZIGB	Ant1	2480	2520	-52.88	-20.00	PASS
ZIGB	Ant1	2480	2521	-52.77	-20.00	PASS
ZIGB	Ant1	2480	2522	-52.92	-20.00	PASS
ZIGB	Ant1	2480	2523	-52.25	-20.00	PASS



ZIGB-Ant1-2405-PASS



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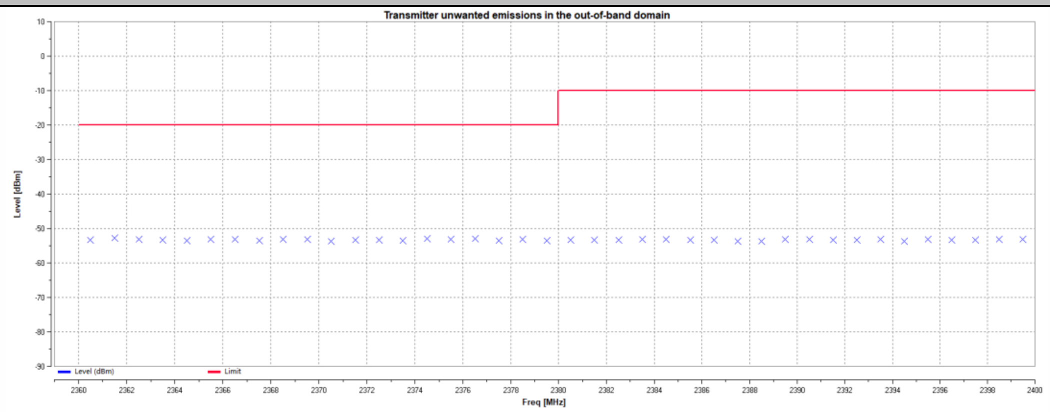
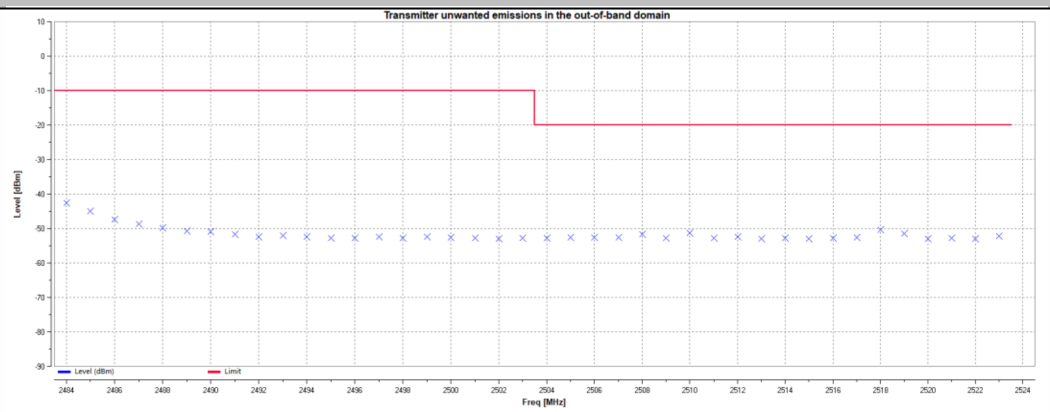


ZIGB-Ant1-2480-PASS



ZIGB-Ant1-2480-PASS

8.5 TRANSMITTER UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN

8.5.1 Applicable standard

ETSI EN 300 328 clause 4.3.2.9

8.5.2 Conformance Limit

The transmitter unwanted emissions in the spurious domain shall not exceed the values given in below.
In case of equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted). For emissions radiated by the cabinet or emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and as e.i.r.p. for emissions above 1 GHz.

Frequency range	Maximum power	Bandwidth
30 MHz to 47 MHz	-36 dBm	100 kHz
47 MHz to 74 MHz	-54 dBm	100 kHz
74 MHz to 87,5 MHz	-36 dBm	100 kHz
87,5 MHz to 118 MHz	-54 dBm	100 kHz
118 MHz to 174 MHz	-36 dBm	100 kHz
174 MHz to 230 MHz	-54 dBm	100 kHz
230 MHz to 470 MHz	-36 dBm	100 kHz
470 MHz to 694 MHz	-54 dBm	100 kHz
694 MHz to 1 GHz	-36 dBm	100 kHz
1 GHz to 12,75 GHz	-30 dBm	1 MHz

8.5.3 Test Configuration

The measurements for emissions in the spurious domain shall only be performed at normal test conditions.
Radiated measurements shall be used for equipment.
Conducted measurements shall be used for equipment.

8.5.4 TEST PROCEDURE

1. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.9.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.9.2 for the measurement methods.

■ Conducted measurement
● Introduction
The spectrum in the spurious domain (see figure 1 or figure 3) shall be searched for emissions that exceed the limit values given in table 4 or table 12 or that come to within 6 dB below these limits. Each occurrence shall be recorded.
The measurement procedure contains 2 parts.
● Pre-scan
The test procedure below shall be used to identify potential unwanted emissions of the UUT.
Step 1:
The sensitivity of the measurement set-up should be such that the noise floor is at least 12 dB below the limits given in table 4 or table 12.
Step 2:
The emissions over the range 30 MHz to 1 000 MHz shall be identified.
Spectrum analyser settings:
• Resolution bandwidth: 100 kHz
Video bandwidth: 300 kHz
• Filter type: 3 dB (Gaussian)
• Detector mode: Peak
• Trace Mode: Max Hold
• Sweep Points: ≥ 19 400; For spectrum analysers not supporting this high number of sweep points, the frequency band may need to be segmented.
• Sweep time: For non continuous transmissions (duty cycle less than 100 %), the sweep time shall be sufficiently long, such that for each 100 kHz frequency step, the measurement time is greater than two transmissions of the UUT, on any channel.
For Frequency Hopping equipment operating in a normal operating (hopping not disabled) mode, the sweep time

shall be further increased to capture multiple transmissions on any of the hopping frequencies.
The above sweep time setting may result in long measuring times in case of frequency hopping equipment. To avoid such long measuring times, an FFT analyser could be used.
Allow the trace to stabilize. Any emissions identified during the sweeps above and that fall within the 6 dB range below the applicable limit or above, shall be individually measured using the procedure in clause 5.4.9.2.1.3 and compared to the limits given in table 4 or table 12.
Step 3:
The emissions over the range 1 GHz to 12,75 GHz shall be identified.
Spectrum analyser settings:
• Resolution bandwidth: 1 MHz
• Video bandwidth: 3 MHz
• Filter type: 3 dB (Gaussian)
• Detector mode: Peak
• Trace Mode: Max Hold
• Sweep Points: ≥ 23 500; For spectrum analysers not supporting this high number of sweep points, the frequency band may need to be segmented.
• Sweep time: For non continuous transmissions (duty cycle less than 100 %), the sweep time shall be sufficiently long, such that for each 1 MHz frequency step, the measurement time is greater than two transmissions of the UUT, on any channel.
For Frequency Hopping equipment operating in a normal operating (hopping not disabled) mode, the sweep time shall be further increased to capture multiple transmissions on any of the hopping frequencies.
The above sweep time setting may result in long measuring times in case of frequency hopping equipment. To avoid such long measuring times, an FFT analyser could be used.
Allow the trace to stabilize. Any emissions identified during the sweeps above that fall within the 6 dB range below the applicable limit or above, shall be individually measured using the procedure in clause 5.4.9.2.1.3 and compared to the limits given in table 4 or table 12.
Frequency Hopping equipment may generate a block (or several blocks) of spurious emissions anywhere within the spurious domain. If this is the case, only the highest peak of each block of emissions shall be measured using the procedure in clause 5.4.9.2.1.3.
Step 4:
• In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains), step 2 and step 3 need to be repeated for each of the active transmit chains (Ach).The limits used to identify emissions during this pre-scan need to be reduced with 10 × log10 (Ach) (number of active transmit chains).

● Measurement of the emissions identified during the pre-scan

The procedure in step 1 to step 4 below shall be used to accurately measure the individual unwanted emissions identified during the pre-scan measurements above. This method assumes the spectrum analyser has a Time Domain Power function.
Step 1:
The level of the emissions shall be measured using the following spectrum analyser settings:
• Measurement Mode: Time Domain Power
• Centre Frequency: Frequency of the emission identified during the pre-scan
• Resolution Bandwidth: 100 kHz (< 1 GHz) / 1 MHz (> 1 GHz)
• Video Bandwidth: 300 kHz (< 1 GHz) / 3 MHz (> 1 GHz)
• Frequency Span: Zero Span
• Sweep mode: Single Sweep
• Sweep time: > 120 % of the duration of the longest burst detected during the measurement of the RF Output Power
• Sweep points: Sweep time [μs] / (1 μs) with a maximum of 30 000
• Trigger: Video (burst signals) or Manual (continuous signals)
• Detector: RMS
Step 2:
• Set a window where the start and stop indicators match the start and end of the burst with the highest level and record the value of the power measured within this window. If the spurious emission to be measured is a continuous transmission, the measurement window shall be set to match the start and stop times of the sweep.
Step 3:
In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains), step 2 needs to be repeated for each of the active transmit chains (Ach).
Sum the measured power (within the observed window) for each of the active transmit chains.
Step 4:

The value defined in step 3 shall be compared to the limits defined in table 4 or table 12.

■ Radiated measurement

The test site as described in annex B and applicable measurement procedures as described in annex C shall be used.

The test procedure is further as described under clause 5.4.9.2.1.

8.5.5 Test Results

All the modulation modes were tested; the data of the worst mode are described in the following table.

Below 1GHz

Operation Mode: ☒802.15.4

Operation frequency: ☒ 2405 MHz ☐ 2480 MHz

Temperature: 25ºC **Humidity:** 60 % RH

Frequency (MHz)	Antenna Polarization	Emission level (dBm)	Limit (dBm)	Over Limit (dBm)	Verdict
54.0608	V	-63.62	-54.00	9.62	PASS
351.9104	V	-73.44	-36.00	37.44	PASS
420.6001	V	-59.21	-36.00	23.21	PASS
648.0136	V	-63.25	-54.00	9.25	PASS
720.196	V	-67.01	-36.00	31.01	PASS
998.8358	V	-68.23	-36.00	32.23	PASS
53.8668	H	-73.66	-54.00	19.66	PASS
256.6373	H	-75.79	-36.00	39.79	PASS
421.1822	H	-67.03	-36.00	31.03	PASS
624.1468	H	-63.74	-54.00	9.74	PASS
765.019	H	-67.99	-36.00	31.99	PASS
978.6557	H	-67.49	-36.00	31.49	PASS

Above 1GHz

Operation Mode: ☒802.15.4

Operation frequency: ☒ 2405 MHz ☐ 2480 MHz

Temperature: 25ºC **Humidity:** 60 % RH

Frequency (MHz)	Antenna Polarization	Emission level (dBm)	Limit (dBm)	Over Limit (dBm)	Verdict
2298.259	V	-53.11	-30.00	23.11	PASS
4808.011	V	-47.85	-30.00	17.85	PASS
6479.495	V	-42.75	-30.00	12.75	PASS
8685.387	V	-37.14	-30.00	7.14	PASS
10785.95	V	-37.27	-30.00	7.27	PASS
12137.57	V	-36.90	-30.00	6.90	PASS
2202.240	H	-52.69	-30.00	22.69	PASS
4809.962	H	-47.60	-30.00	17.60	PASS
6610.172	H	-43.59	-30.00	13.59	PASS
8470.844	H	-37.65	-30.00	7.65	PASS
10060.41	H	-37.46	-30.00	7.46	PASS
12617.37	H	-36.95	-30.00	6.95	PASS

8.6 RECEIVER SPURIOUS EMISSIONS

8.6.1 Applicable standard

ETSI EN 300 328 clause 4.3.2.10

8.6.2 Conformance Limit

The spurious emissions of the receiver shall not exceed the values given in below.

In case of equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted). For emissions radiated by the cabinet or emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and e.i.r.p. for emissions above 1 GHz.

Frequency Range	Maximum power	Measurement Width
30 MHz to 1 GHz	-57 dBm	100kHz
1 GHz to 12.75 GHz	-47 dBm	1MHz

8.6.3 Test Configuration

The measurements for emissions in the spurious domain shall only be performed at normal test conditions.
Radiated measurements shall be used for equipment.
Conducted measurements shall be used for equipment.

8.6.4 Test Procedure

1. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.11.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.11.2 for the measurement methods.

■ Conducted measurement
● Introduction
The spectrum in the spurious domain (see figure 1 or figure 3) shall be searched for emissions that exceed the limit values given in table 4 or table 12 or that come to within 6 dB below these limits. Each occurrence shall be recorded.
The measurement procedure contains 2 parts.
● Pre-scan
The test procedure below shall be used to identify potential unwanted emissions of the UUT.
Step 1:
The sensitivity of the spectrum analyser should be such that the noise floor is at least 12 dB below the limits given in table 5 or table 13.
Step 2:
The emissions over the range 30 MHz to 1 000 MHz shall be identified.
Spectrum analyser settings:
• Resolution bandwidth: 100 kHz
Video bandwidth: 300 kHz
• Filter type: 3 dB (Gaussian)
• Detector mode: Peak
• Trace Mode: Max Hold
• Sweep Points: ≥ 19 400;
• Sweep time: Auto
Wait for the trace to stabilize. Any emissions identified during the sweeps above and that fall within the 6 dB range below the applicable limit or above, shall be individually measured using the procedure in clause 5.4.10.2.1.3 and compared to the limits given in table 5 or table 13.
Step 3:
The emissions over the range 1 GHz to 12,75 GHz shall be identified.
Spectrum analyser settings:
• Resolution bandwidth: 1 MHz

• Video bandwidth: 3 MHz
• Filter type: 3 dB (Gaussian)
• Detector mode: Peak
• Trace Mode: Max Hold
• Sweep Points: ≥ 23 500; For spectrum analysers not supporting this high number of sweep points, the frequency band may need to be segmented.
• Sweep time: Auto

Wait for the trace to stabilize. Any emissions identified during the sweeps above that fall within the 6 dB range below the applicable limit or above, shall be individually measured using the procedure in clause 5.4.10.2.1.3 and compared to the limits given in table 5 or table 13.
FHSS equipment may generate a block (or several blocks) of spurious emissions anywhere within the spurious domain. If this is the case, only the highest peak of each block of emissions shall be measured using the procedure in clause 5.4.10.2.1.3.
Step 4:
• In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains), step 2 and step 3 need to be repeated for each of the active transmit chains (Ach).The limits used to identify emissions during this pre-scan need to be reduced with 10 × log10 (Ach) (number of active transmit chains).
● Measurement of the emissions identified during the pre-scan
The procedure in step 1 to step 4 below shall be used to accurately measure the individual unwanted emissions identified during the pre-scan measurements above. This method assumes the spectrum analyser has a Time Domain Power function.
Step 1:
The level of the emissions shall be measured using the following spectrum analyser settings:
• Measurement Mode: Time Domain Power
• Centre Frequency: Frequency of the emission identified during the pre-scan
• Resolution Bandwidth: 100 kHz (< 1 GHz) / 1 MHz (> 1 GHz)
• Video Bandwidth: 300 kHz (< 1 GHz) / 3 MHz (> 1 GHz)
• Frequency Span: Zero Span
• Sweep mode: Single Sweep
• Sweep time: 30ms
• Sweep points: ⩾30 000
• Trigger: Video (burst signals) or Manual (continuous signals)
• Detector: RMS
Step 2:
• Set a window where the start and stop indicators match the start and end of the burst with the highest level and record the value of the power measured within this window. If the spurious emission to be measured is a continuous transmission, the measurement window shall be set to match the start and stop times of the sweep.
Step 3:
In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains), step 2 needs to be repeated for each of the active transmit chains (Ach).
Sum the measured power (within the observed window) for each of the active transmit chains.
Step 4:
The value defined in step 3 shall be compared to the limits defined in table 4 or table 12.
■ Radiated measurement
The test site as described in annex B and applicable measurement procedures as described in annex C shall be used.
The test procedure is further as described under clause 5.4.9.2.1.

8.6.5 Test Results

All the modulation modes were tested; the data of the worst mode are described in the following table.

Below 1GHz

Operation Mode: ☒802.15.4

Operation frequency: ☒ 2405 MHz ☐ 2480 MHz

Temperature: 25ºC **Humidity:** 55 % RH

Frequency (MHz)	Antenna Polarization	Emission level (dBm)	Limit (dBm)	Over Limit (dBm)	Verdict
54.0608	V	-63.37	-57.00	6.37	PASS
420.018	V	-60.10	-57.00	3.10	PASS
485.7972	V	-61.45	-57.00	4.45	PASS
648.0136	V	-62.79	-57.00	5.79	PASS
720.196	V	-66.56	-57.00	9.56	PASS
981.1782	V	-68.03	-57.00	11.03	PASS
55.225	H	-74.21	-57.00	17.21	PASS
231.2182	H	-75.89	-57.00	18.89	PASS
424.0928	H	-68.46	-57.00	11.46	PASS
624.1468	H	-63.89	-57.00	6.89	PASS
720.002	H	-69.51	-57.00	12.51	PASS
963.3267	H	-68.66	-57.00	11.66	PASS

Above 1GHz

Operation Mode: ☒802.15.4

Operation frequency: ☒ 2405 MHz ☐ 2480 MHz

Temperature: 25ºC **Humidity:** 55 % RH

Frequency (MHz)	Antenna Polarization	Emission level (dBm)	Limit (dBm)	Over Limit (dBm)	Verdict
2293.458	V	-69.21	-47.00	22.21	PASS
4899.679	V	-64.54	-47.00	17.54	PASS
6641.378	V	-59.48	-47.00	12.48	PASS
8162.682	V	-54.58	-47.00	7.58	PASS
9551.360	V	-53.73	-47.00	6.73	PASS
11404.23	V	-53.36	-47.00	6.36	PASS
2196.239	H	-68.87	-47.00	21.87	PASS
4784.606	H	-64.32	-47.00	17.32	PASS
6848.119	H	-59.65	-47.00	12.65	PASS
7973.494	H	-54.65	-47.00	7.65	PASS
10471.94	H	-53.83	-47.00	6.83	PASS
12147.32	H	-53.42	-47.00	6.42	PASS

8.7 ADAPTIVITY (ADAPTIVE EQUIPMENT USING MODULATIONS OTHER THAN FHSS)

8.7.1 Applicable standard

ETSI EN 300 328 clause 4.3.2.6

8.7.2 Conformance Limit

Only for adaptive equipment and RF output power >=10dBm (ERP)

■ For LBT based Detect and avoid equipment shall comply with the following requirement

Load Based Equipment may implement an LBT based spectrum sharing mechanism based on the Clear Channel

Assessment (CCA) mode using energy detect as described in IEEE 802.11™-2012 [i.3], clause 9, clause 10, clause 16, clause 17, clause 19 and clause 20, or in IEEE 802.15.4™-2011 [i.4], clause 4, clause 5 and clause 8 providing the equipment complies with the conformance requirements referred to in clause 4.3.2.6.3.4. Load Based Equipment not using any of the mechanisms referenced above shall comply with the following minimum set of requirements:

1) Before a transmission or a burst of transmissions, the equipment shall perform a Clear Channel Assessment (CCA) check using energy detect. The equipment shall observe the operating channel for the duration of the CCA observation time which shall be not less than 18 μs. The channel shall be considered occupied if the energy level in the channel exceeds the threshold given in step 5 below. If the equipment finds the channel to be clear, it may transmit immediately.

2) If the equipment finds the channel occupied, it shall not transmit on this channel (see also the next paragraph). The equipment shall perform an Extended CCA check in which the channel is observed for a random duration in the range between 18 μs and at least 160 μs. If the extended CCA check has determined the channel to be no longer occupied, the equipment may resume transmissions on this channel. If the Extended CCA time has determined the channel still to be occupied, it shall perform new Extended CCA checks until the channel is no longer occupied.

NOTE: The Idle Period in between transmissions is considered to be the CCA or the Extended CCA check

as there are no transmissions during this period. The equipment is allowed to switch to a non-adaptive mode and to continue transmissions on this channel providing it complies with the requirements applicable to non-adaptive equipment. Alternatively, the equipment is also allowed to continue Short Control Signalling Transmissions on this channel providing it complies with the requirements given in clause 4.3.2.6.4.

3) The total time that an equipment makes use of a RF channel is defined as the Channel Occupancy Time. This Channel Occupancy Time shall be less than 13 ms, after which the device shall perform a new CCA as described in step 1 above.

4) The equipment, upon correct reception of a packet which was intended for this equipment can skip CCA and immediately (see also next paragraph) proceed with the transmission of management and control frames (e.g. ACK and Block ACK frames are allowed but data frames are not allowed). A consecutive sequence of transmissions by the equipment without a new CCA shall not exceed the maximum channel occupancy time as defined in step 3 above.

For the purpose of multi-cast, the ACK transmissions (associated with the same data packet) of the individual devices are allowed to take place in a sequence.

5) The energy detection threshold for the CCA shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the CCA threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account. For power levels less than 20 dBm e.i.r.p., the CCA threshold level may be relaxed to:

TL = -70 dBm/MHz + 10 × log10 (100 mW / Pout) (Pout in mW e.i.r.p.)

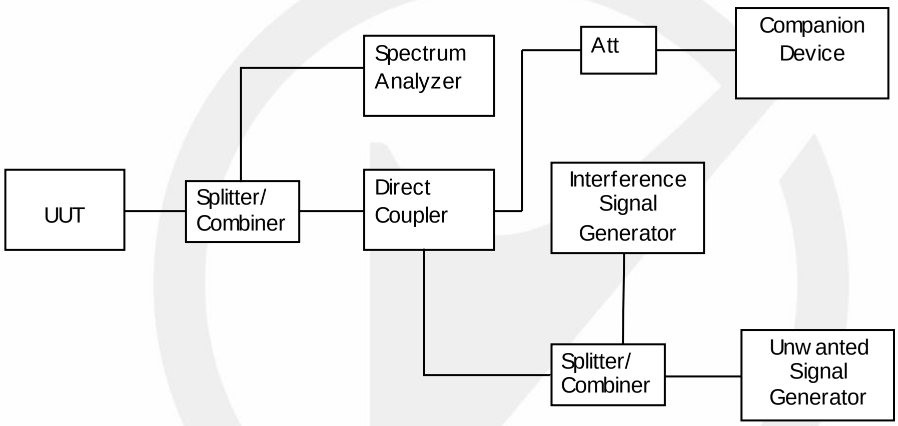
6) The equipment shall comply with the requirements defined in step 1 to step 4 of the present clause in the presence of an unwanted CW signal as defined in below.

Unwanted Signal parameters

Wanted signal mean power from companion device	Unwanted signal frequency (MHz)	Unwanted signal power (dBm)
sufficient to maintain the link (see note 2)	2 395 or 2 488,5 (see note 1)	-35 (see note 3)
NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. See clause 5.4.6.1. NOTE 2: A typical value which can be used in most cases is -50 dBm/MHz. NOTE 3: The level specified is the level in front of the UUT antenna. In case of conducted measurements, this level has to be corrected by the actual antenna assembly gain.		

■ Short control signaling transmissions
If implemented, Short Control Signalling Transmissions of adaptive equipment using wide band modulations other than FHSS shall have a maximum TxOn / (TxOn + TxOff) ratio of 10 % within any observation period of 50 ms.

8.7.3 Test Configuration



8.7.4 Test Procedure

1. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.6.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.6.2 for the measurement method.

Step 1 to step 7 below define the procedure to verify the efficiency of the LBT based adaptive mechanism of equipment using wide band modulations other than FHSS. This method can be applied on Load Based Equipment and Frame Based Equipment.
Step 1:
• The UUT shall connect to a companion device during the test. The interference signal generator, the unwanted signal generator, the spectrum analyser, the UUT and the companion device are connected using a set-up equivalent to the example given by figure 5 although the interference and unwanted signal generator do not generate any signals at this point in time. The spectrum analyser is used to monitor the transmissions of both the UUT and the companion device and it should be possible to distinguish between either transmission. In addition, the spectrum analyser is used to monitor the transmissions of the UUT in response to the interfering and the unwanted signals.
• Adjust the received signal level (wanted signal from the companion device) at the UUT to the value defined in table 10 (clause 4.3.2.6.3.2.2) for Frame Based Equipment or in table 11 (clause 4.3.2.6.3.2.3) for Load Based Equipment.
Testing of Unidirectional equipment does not require a link to be established with a companion device.
• The analyser shall be set as follows:
- RBW: ⩾ Occupied Channel Bandwidth (if the analyser does not support this setting, the highest available setting shall be used)
- VBW: 3 × RBW (if the analyser does not support this setting, the highest available setting shall be used)
- Detector Mode: RMS

- Centre Frequency: Equal to the centre frequency of the operating channel
- Span: 0 Hz
- Sweep time: > maximum Channel Occupancy Time
- Trace Mode: Clear Write
- Trigger Mode: Video

Step 2:

• Configure the UUT for normal transmissions with a sufficiently high payload resulting in a minimum transmitter activity ratio (TxOn / (TxOn + TxOff)) of 0,3. Where this is not possible, the UUT shall be configured to the maximum payload possible.

• For Frame Based Equipment, using the procedure defined in clause 5.4.6.2.1.5, it shall be verified that the UUT complies with the maximum Channel Occupancy Time and minimum Idle Period defined in clause 4.3.2.6.3.2.2, step 3. When measuring the Idle Period of the UUT, it shall not include the transmission time of the companion device.

• For Load Based equipment, using the procedure defined in clause 5.4.6.2.1.5, it shall be verified that the UUT complies with the maximum Channel Occupancy Time and minimum Idle Period defined in clause 4.3.2.6.3.2.3, step 2 and step 3. When measuring the Idle Period of the UUT, it shall not include the transmission time of the companion device.

For the purpose of testing Load Based Equipment referred to in the first paragraph of clause 4.3.2.6.3.2.3 (IEEE 802.11™ [i.3] or IEEE 802.15.4™ [i.4] equipment), the limits to be applied for the minimum Idle Period and the maximum Channel Occupancy Time are the same as defined for other types of Load Based Equipment (see clause 4.3.2.6.3.2.3, step 2 and step 3). The Idle Period is considered to be equal to the CCA or Extended CCA time defined in clause 4.3.2.6.3.2.3, step 1 and step 2.

Step 3: Adding the interference signal

• An interference signal as defined in clause B.7 is injected on the current operating channel of the UUT. The power spectral density level (at the input of the UUT) of this interference signal shall be equal to the detection threshold defined in clause 4.3.2.6.3.2.2, step 5 (frame based equipment) or clause 4.3.2.6.3.2.3, step 5 (load based equipment).

Step 4: Verification of reaction to the interference signal

• The spectrum analyser shall be used to monitor the transmissions of the UUT on the selected operating channel with the interfering signal injected. This may require the spectrum analyser sweep to be triggered by the start of the interfering signal.

• Using the procedure defined in clause 5.4.6.2.1.5, it shall be verified that:

i) The UUT shall stop transmissions on the current operating channel.

The UUT is assumed to stop transmissions within a period equal to the maximum Channel Occupancy Time defined in clause 4.3.2.6.3.2.2 (frame based equipment) or clause 4.3.2.6.3.2.3 (load based equipment).

ii) Apart from Short Control Signalling Transmissions, there shall be no subsequent transmissions while the interfering signal is present.

To verify that the UUT is not resuming normal transmissions as long as the interference signal is present, the monitoring time may need to be 60 s or more.

iii) The UUT may continue to have Short Control Signalling Transmissions on the operating channel while the interfering signal is present. These transmissions shall comply with the limits defined in clause 4.3.2.6.4.2.

The verification of the Short Control Signalling transmissions may require the analyser settings to be changed (e.g. sweep time).

iv) Alternatively, the equipment may switch to a non-adaptive mode.

Step 5: Adding the unwanted signal

• With the interfering signal present, a 100 % duty cycle CW signal is inserted as the unwanted signal. The frequency and the level are provided in table 10 (clause 4.3.2.6.3.2.2) for Frame Based Equipment or in table 11 (clause 4.3.2.6.3.2.3) for Load Based Equipment.

• The spectrum analyser shall be used to monitor the transmissions of the UUT on the selected operating channel. This may require the spectrum analyser sweep to be triggered by the start of the unwanted signal.

• Using the procedure defined in clause 5.4.6.2.1.5, it shall be verified that:

i) The UUT shall not resume normal transmissions on the current operating channel as long as both the interference and unwanted signals remain present.

To verify that the UUT is not resuming normal transmissions as long as the interference and unwanted signals are present, the monitoring time may need to be 60 s or more.

ii) The UUT may continue to have Short Control Signalling Transmissions on the operating channel while the interfering and unwanted signals are present. These transmissions shall comply with the limits defined in clause 4.3.2.6.4.2.
The verification of the Short Control Signalling transmissions may require the analyser settings to be changed (e.g. sweep time).
Step 6: Removing the interference and unwanted signal
• On removal of the interference and unwanted signals the UUT is allowed to start transmissions again on this channel; however, this is not a requirement and, therefore, does not require testing.
Step 7:
• Step 2 to step 6 shall be repeated for each of the frequencies to be tested.

8.7.5 Test Results

Mode	Output Power	Remarks	Pass/Fail
☒RF_A	≤10dBm	Not Applicable	N/A

8.8 RECEIVER BLOCKING

8.8.1 Applicable standard

ETSI EN 300 328 clause 4.3.2.11

8.8.2 Conformance Limit

For equipment that supports a PER or FER test to be performed, the minimum performance criterion shall be a PER or FER less than or equal to 10 %.
For equipment that does not support a PER or a FER test to be performed, the minimum performance criterion shall be no loss of the wireless transmission function needed for the intended use of the equipment.

■ General

While maintaining the minimum performance criteria as defined in clause 4.3.2.11.3, the blocking levels at specified frequency offsets shall be equal to or greater than the limits defined for the applicable receiver category provided in below.

●Receiver Category 1

Receiver blocking parameters for Receiver Category 1 equipment

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 4)	Type of blocking signal
(-133 dBm + 10 × log10(OCBW)) or -68 dBm whichever is less (see note 2)	2 380 2 503,5	-34	CW
(-139 dBm + 10 × log10(OCBW)) or -74 dBm whichever is less (see note 3)	2 300 2 330 2 360 2 524 2 584 2 674	-34	CW

NOTE 1: OCBW is in Hz.
NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to Pmin + 26 dB where Pmin is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 3: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to Pmin + 20 dB where Pmin is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 4: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.

●Receiver Category 2

Receiver blocking parameters receiver category 2 equipment

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + 10 × log10(OCBW) + 10 dB) or (-74 dBm + 10 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW

NOTE 1: OCBW is in Hz.

NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to Pmin + 26 dB where Pmin is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.

NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.

●Receiver Category 3

Receiver blocking parameters receiver category 3 equipment

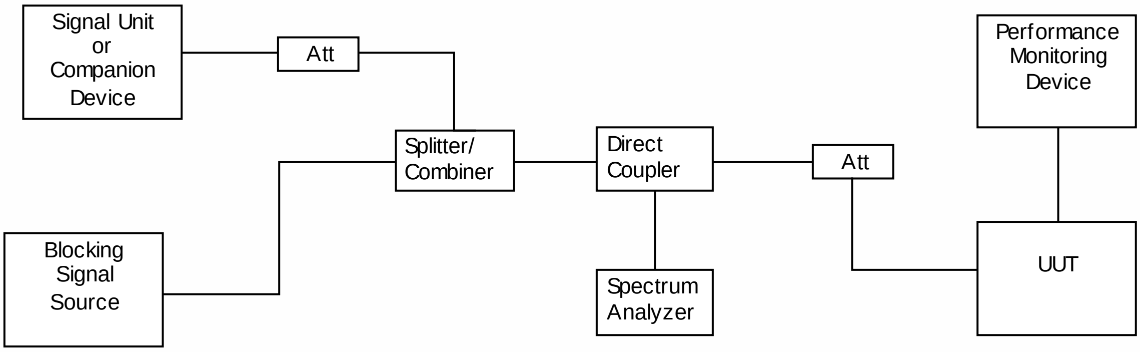
Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + 10 × log10(OCBW) + 20 dB) or (-74 dBm + 20 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW

NOTE 1: OCBW is in Hz.

NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to Pmin + 30 dB where Pmin is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal

NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.

8.8.3 Test Configuration



8.8.4 Test Procedure

1. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.11.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.11.2 for the measurement method.

■ Conducted measurement
Adaptive Frequency Hopping equipment using DAA
Step 1:
• For non-FHSS equipment, the UUT shall be set to the lowest operating channel on which the blocking test has to be performed (see clause 5.4.11.1).
Step 2:
• The blocking signal generator is set to the first frequency as defined in the appropriate table corresponding to the receiver category and type of equipment.
Step 3:
• With the blocking signal generator switched off, a communication link is established between the UUT and the associated companion device using the test setup shown in figure 6.
• Unless the option provided in note 2 of the applicable table referred to in clause 5.4.11.2.1 is used, the level of the wanted signal shall be set to the value provided in the table corresponding to the receiver category and type of equipment. The test procedure defined in clause 5.4.2, and more in particular clause 5.4.2.2.1.2, can be used to measure the (conducted) level of the wanted signal however no correction shall be made for antenna gain of the companion device (step 6 in clause 5.4.2.2.1.2 shall be ignored). This level may be measured directly at the output of the companion device and a correction is made for the coupling loss into the UUT. The actual level for the wanted signal shall be recorded in the test report.
• When the option provided in note 2 of the applicable table referred to in clause 5.4.11.2.1 is used, the attenuation of the variable attenuator shall be increased in 1 dB steps to a value at which the minimum performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still met. The resulting level for the wanted signal at the input of the UUT is Pmin. This signal level (Pmin) is increased by the value provided in note 2 of the applicable table corresponding to the receiver category and type of equipment.
Step 4:
• The blocking signal at the UUT is set to the level provided in the table corresponding to the receiver category and type of equipment.
• If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 are met then proceed to step 6.
Step 5:
• If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is not met, step 3 and step 4 shall be repeated after that the frequency of the blocking signal set in step 2 has been increased with a value equal to the Occupied Channel Bandwidth except:

- For the blocking frequency 2 380 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be increased by 3 dB.
- For the blocking frequency 2 503,5 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be decreased by 3 dB.

• If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still not met, step 3 and step 4

shall be repeated after that the frequency of the blocking signal set in step 2 has been decreased with a value equal to the Occupied Channel Bandwidth except:
- For the blocking frequency 2 380 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be decreased by 3 dB.
- For the blocking frequency 2 503,5 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be increased by 3 dB.
• If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still not met, the UUT fails to comply with the Receiver Blocking requirement and step 6 and step 7 are no longer required.
• It shall be recorded in the test report whether the shift of blocking frequencies as described in the present step was used.
Step 6:
• Repeat step 4 and step 5 for each remaining combination of frequency and level for the blocking signal as provided in the table corresponding to the receiver category and type of equipment.
Step 7:
• For non-FHSS equipment, repeat step 2 to step 6 with the UUT operating at the highest operating channel on which the blocking test has to be performed (see clause 5.4.11.1).
Step 8:
• It shall be assessed and recorded in the test report whether the UUT complies with the Receiver Blocking requirement.

■ Radiated measurements
When performing radiated measurements on equipment with dedicated antennas, measurements shall be repeated for each alternative dedicated antenna.
The power levels specified in table 6, table 7, table 8, table 14, table 15 and table 16 can be converted to a corresponding power flux density (PFD) value using the formula below

$$PFD = P + 11 - 20 \times \log10(300 / F)$$

'P' is the power level in dBm
'F' is the frequency in MHz

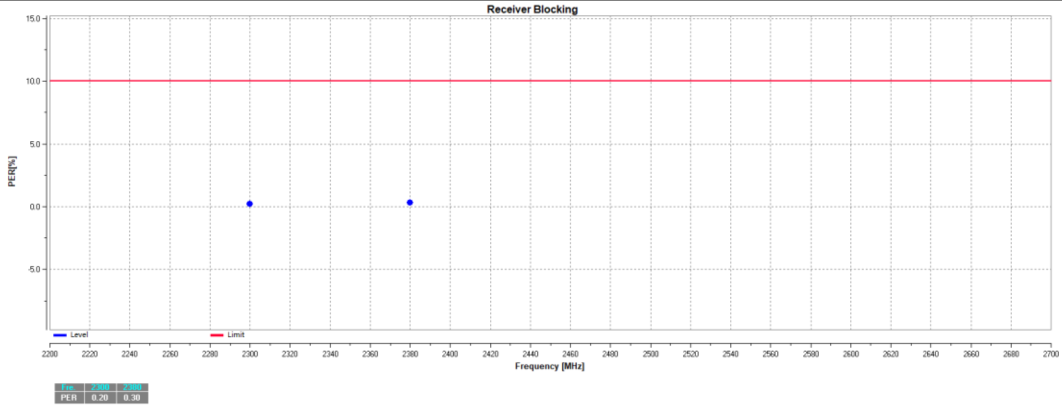
A test site as described in annex B and applicable measurement procedures as described in annex C shall be used.
The test procedure is further as described under clause 5.4.11.2.1
The level of the blocking signal at the UUT referred to in step 4 is assumed to be the level in front of the UUT antenna(s). The UUT shall be positioned with its main beam pointing towards the antenna radiating the blocking signal. The position recorded in clause 5.4.2.2.2 can be used.

8.8.5 Test Results

Receiver category

☐	Receiver category 1	Adaptive equipment with a maximum RF output power greater than 10 dBm e.i.r.p. shall be considered as receiver category 1 equipment.
☒	Receiver category 2	Non-adaptive equipment with a Medium Utilization (MU) factor greater than 1 % and less than or equal to 10 % or adaptive equipment with a maximum RF output power of 10 dBm e.i.r.p. shall be considered as receiver category 2 equipment.
☐	Receiver category 3	Non-adaptive equipment with a maximum Medium Utilization (MU) factor of 1 % or adaptive equipment with a maximum RF output power of 0 dBm e.i.r.p. shall be considered as receiver category 3 equipment.

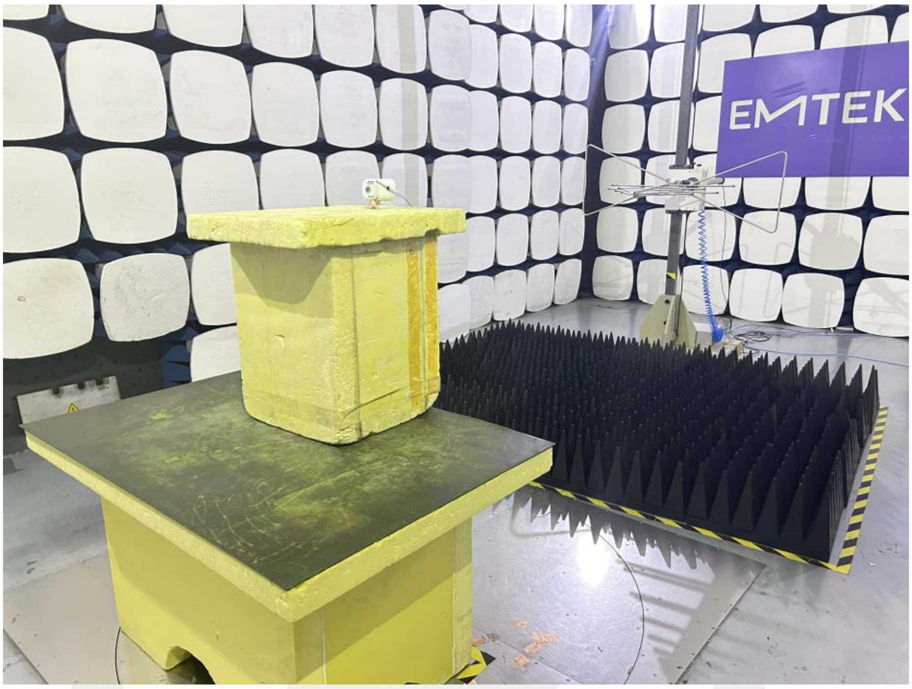
TestMode	Antenna	Frequency [MHz]	Wanted signal [dBm]	Freq. [MHz]	CW [dBm]	PER [%]	Limit [%]	Verdict
ZIGB	Ant1	2405	-65.18	2300	-33.68	0.20	≤10	PASS
ZIGB	Ant1	2405	-65.18	2380	-33.68	0.30	≤10	PASS



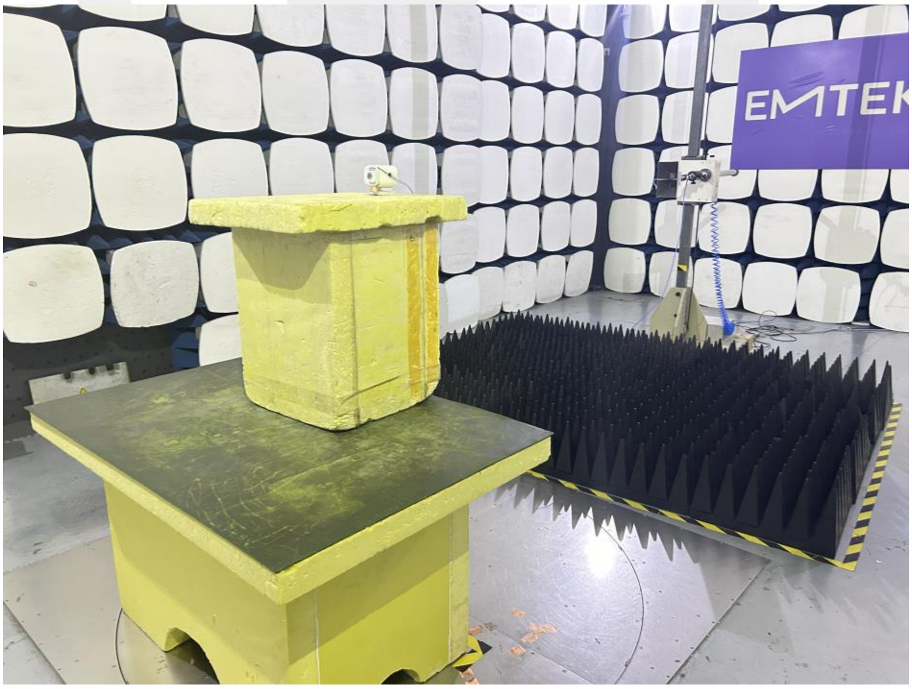
ZIGB-Ant1-2405-PASS

9. APPENDIX PHOTOGRAPHS OF TEST SETUP

Spurious Emission Test Setup (Below 1GHz)



Spurious Emission Test Setup (Above 1GHz)



*** End of Report ***